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INTRINSIC CANCER
OF THE LARYNX
AND THE OPERATION OF
LARYNGO-FISSURE

IRWIN MOORE

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INTRINSIC CANCER OF THE LARYNX AND THE OPERATION OF LARYNGO-FISSURE



BY
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WITH FORTY-SIX ORIGINAL ILLUSTRATIONS

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PREFACE

FOLLOWING the publication of a series of articles on Intrinsic Cancer of the Larynx and the operation of Laryngofissure in the *Journal of Laryngology, Rhinology, and Otology*, 1918, Vol. xxxiii, I have received so many requests for copies that I have been induced to republish the subject with further additions in book form.

I am the more willing to do this as I feel confident—judging from the satisfactory results already obtained in the operative treatment of intrinsic cancer of the larynx—that in early cases we are justified in looking forward to even greater success, and still further reduction in the death rate. Experience has shown that cancer, in this situation, is of a slow progressive character in its earlier stages, due partly to the arrangements of the lymphatic drainage of the larynx, and partly to the strong resisting barrier of the perichondrium and surrounding cartilage, hence it is not until a late stage that the cartilage or glands in the neck become involved.

Since the chief and characteristic symptom of the disease, in the early stages, is alteration in the voice or persistent hoarseness, it is evident that such definite warning is of infinite value in the early diagnosis of the disease, and indicates the importance not only of more serious discrimination by the general physician, but also of more frequent co-operation with the laryngologist.

One leading authority, referring to twenty-three cases of cancer of the larynx which he had seen, states that “only one was in its early stage,” and he considers this a “terrible commentary on the present condition of the diagnosis of

this disease." He thinks that "the fault lies largely with the general practitioner, who does not take sufficient notice of the early symptoms," and he advises that "anyone of cancer age complaining of hoarseness, which lasts for more than six weeks, should be kept under careful observation."

The unhappy lot of those who have passed the primary stage, that is, the ideal stage for laryngo-fissure, and reached the stage in which the disease has attacked the cartilage, necessitating total removal of the larynx, is well described by a recent writer, who, referring to the pitiable and pathetic condition of these patients, remarks, "Life under such circumstances, cut off from all communication with the world, is hardly worth living," and that "anything which will avoid a total laryngectomy is a godsend."

As in the case of venereal disease, it should be made an indictable offence for any unqualified person to exploit cancer or catarrhal affections of the throat, by means of advertisements in the lay press, and the necessity of legislative protection of the uneducated and credulous public demands the most serious consideration.

It is my earnest hope that the re-publication of this short monograph may encourage still further the early diagnosis of cancer of the larynx, and so improve the opportunity which the operation of laryngo-fissure offers, in the hands of the experienced and skilled laryngologist, for the cure of this terrible disease.

The illustrations have been specially drawn for me by Mr. Thornton Shiells, to whom I am indebted for the great care he has bestowed on them. I am also indebted to the *Journal of Laryngology, Rhinology, and Otology* for permission to republish, and to Mr. Powell, Librarian of the Royal Society of Medicine, for valuable assistance in verifying many of the references.

30A, WIMPOLE STREET,
LONDON, W.

February, 1921.

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INTRINSIC CANCER OF THE LARYNX AND THE OPERATION OF LARYNGO-FISSURE

CHAPTER I

INTRODUCTION AND STATISTICS

The Registrar-General's Returns of Cancer.—Cancer of the larynx is comparatively rare in comparison with its occurrence in other organs of the body, though it occurs more frequently in this situation than in the naso-pharynx and pharynx combined.

The returns of the Registrar-General for the years 1901–9 show an increase of cancer during this period, irregularly distributed over the various organs of the body. In males the main increase fell upon the alimentary tract, and especially upon the stomach. The increased mortality mainly affected the higher age periods. This apparently shows that the increase in cancer is partly due to the general increase in longevity (Sampson Handley).¹

But there is evidence that the increase in cancer is a real one and not merely apparent, and dependent on increase in longevity.

The returns of the Registrar-General for England and Wales (1910–15) show that the total number of deaths from cancer in 1915 amounted to 39,847 as compared with 35,902 in 1911.

Statistics of Cancer of the Larynx.—According to the mortality returns of this country, in every hundred cancer

¹ Sampson Handley, "Cancer Mortality," "Med. Annual," 1912, p. 195.

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deaths 21 are stomach to 1·8 larynx, whilst American returns show that 43 are stomach to 1 larynx (Roger Williams).¹

In the seventieth report for England and Wales (1910) we find that the average total number of deaths from laryngeal cancer per year on a 10 years' average (1901–10) amounts to 334, whilst the seventy-fifth report (1915) shows that the yearly average for the 5 years (1911–15) has increased to 534.

Many primary cases of pharyngeal cancer were probably included under the heading extrinsic laryngeal cancer, and this refers also, in all probability, to subsequently quoted statistics.

Gürlt² (Berlin) stated in 1880 that out of 11,131 cases of carcinoma recorded in three large hospitals he only found it 63 times in the larynx, or 1 in 176, compared with 47 in the air tract above.

Semon,³ in 1889, gathered the statistics of all laryngeal growths, amounting, all told, to 10,747 non-malignant cases and 1550 malignant cases—1 in 7 being malignant.

Epithelioma (squamous-celled carcinoma) is the most frequent growth in the larynx, and is generally a primary affection.

Cylindrical or columnar-celled carcinoma is extremely rare, and only one case is reported by Butlin.⁴

Bosworth⁵ (New York) collected 334 cases prior to 1900, of which 204 were carcinomata and 130 sarcomata. This is not in agreement with modern statistics, for sarcoma is considered rare in this position.

Morell Mackenzie⁶ met with only 5 cases of sarcoma, whilst Butlin⁷ mentions 25 cases as having been collected by him.

¹ Cited by Scanes Spicer, "Proc. Roy. Soc. Med.," 1910, iv (Sect. Laryngol.), p. 20.

² *Arch. für Klin. Chir.*, 1880, xxv, p. 426; also cited by Price-Brown, "Dis. Nose and Throat," 1st edit., 1901, p. 437.

³ "*Internat. Centralblatt für Laryngologie*," 1889, pp. 284–289. Cited by Ballenger, "Dis. Nose and Throat," 1st edit., 1908, p. 525.

⁴ "Malignant Diseases of the Larynx," 1883, p. 34.

⁵ Cited by Ballenger, *op. cit.*, p. 525.

⁶ "Dis. of the Throat and Nose," 1880, i, p. 350.

⁷ *Op. cit.*, 1883, p. 6.

Ziemssen¹ (Munich) reported 57 epitheliomata in 68 malignant cases, of which 9 were sarcomata.

Massei² (Naples), in tabulating 500 cases of laryngeal neoplasm, mentions having met with epithelioma in 67, and sarcoma in 10 cases.

Since carcinoma and sarcoma are usually indistinguishable clinically, it is unnecessary to consider them separately.

Ætiology of Cancer of the Larynx.—As in other parts of the body, it is still unsolved.

It is interesting to note, however, that a large number of cases are reported in which the patient was addicted to alcohol and to smoking, especially the latter, with their accompanying local irritation; also others in which the voice was overstrained or overworked.

Chiari³ (Vienna) has expressed the opinion with great reserve that “continued irritation of the mucosa of the larynx, *e.g.*, by excessive drinking and smoking, recurring catarrhs, syphilis, and finally, heredity, are to be considered as probable causes of cancer of the larynx.”

Chevalier Jackson⁴ (Philadelphia) says we cannot ignore the influence of chronic laryngitis as at least a predisposing cause of cancer of the larynx, and that specific ulcerations and benign growths can prepare a soil more favourable than normal tissues for the invasion of cancer.

StClair Thomson⁵ on the other hand considers that such predisposing causes have been blamed without sufficient justification.

There seems little doubt, however, that specific lesions may supply the local irritation which favours the occurrence of epithelioma, as shown by cases reported.

¹ “Cyclopædia of Med.,” 1877, vii, p. 891. Cited by Ballenger, *op. cit.*, p. 525.

² “*Arch. ital. di laringol.*,” Napoli; 1897, xvii, pp. 110–120. Cited by Shurley, “Dis. of Throat and Nose,” 1st edit., 1900, p. 572.

³ “Proc. Amer. Laryngol., Rhinol., and Otol. Soc.,” 1909, p. 3. Abstract, *Laryngoscope*, 1909, xix, p. 955.

⁴ “Peroral Endoscopy and Laryngeal Surgery,” 1915, p. 647.

⁵ “Dis. of Throat and Nose,” 2nd edit., 1916, p. 485.

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Lunin¹ (Petersburg) reports a case where the epithelioma was growing out from a syphilitic cicatrix.

Keimer² (Dusseldorf) refers to two cases of carcinoma following gumma of the larynx in patients who took alcohol to excess, smoked heavily, and used their voice excessively.

That carcinoma is to some extent hereditary is alleged to have been shown by clinical evidence³ and investigations.⁴ According to Leslie Davis (Philadelphia),⁵ hereditary history can only be obtained in less than 10 per cent. of cases.

Ledoux-Lebard⁶ (Paris) states that out of 42 patients with cancer, 7 had a family history of cancer, *i.e.*, 16.6 per cent.

Cancer Metastasis to and from the larynx, especially the former, is of rare occurrence (*vide* p. 118).

Morell Mackenzie⁷ states that he knew of only one case in which the primary disease in the larynx developed secondarily in other parts of the body.

Rollier⁸ (Trèves) reports a case in which metastases in the lungs, liver and brain followed sarcoma and suppurative perichondritis of the larynx.

Herrmann⁹ (Berne) mentions an example of lymphosarcomatous metastases to the larynx and trachea.

Lennox Browne¹⁰ quotes several instances of metastases to the lumbar glands, kidneys and liver.

Butlin,¹¹ amongst 50 collected cases of malignant disease

¹ *Petersb. Med. Woch.*, No. 17, 1899. Abstract, *Journ. of Laryngol. Rhinol., and Otol.*, 1899, xiv, p. 432.

² *Monatschrift für Ohrenheilkunde*, 1899, xxviii, p. 65. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 431.

³ Williams, Roger, "The Natural History of Cancer," 1908, p. 356.

⁴ Murray, J. A., "Scientific Report of Imperial Cancer Research," 1911, iv, p. 114.

⁵ *Laryngoscope*, 1908, xviii, p. 372.

⁶ "Report on the Question of Heredity of Cancer." *Bull. d. l'Assoc. franc. p. l'étude du Cancer*, 1908, pp. 92-112. Quoted by Sampson Handley, "Med. Ann.," 1910, p. 204.

⁷ *Op. cit.*, p. 336.

⁸ "Internat. Centralblatt für Laryngologie," 1886, ii, p. 320. Cited by Hunter Mackenzie, *Journ. Laryngol. and Rhinol.*, 1888, ii, p. 287.

⁹ "Beiträge zur Kenntniss der malignen Lymphdrüsen Geschwülste," Berne, 1885. Cited by Hunter Mackenzie, *op cit.*, p. 287.

¹⁰ *Op. cit.*, p. 439.

¹¹ *Op. cit.*, p. 50.

of the larynx, found that three had metastatic deposits in the kidneys, liver and lungs, besides affections of various glands in each instance.

H. S. Birkett and A. G. Nicholls¹ (Montreal) record a case of carcinoma of the larynx where four or five secondary nodules were found *post mortem* in the liver. The carcinoma was confined to the left vocal cord and had not apparently extended outside the laryngeal cavity.

Age.—Malignant growths of the larynx are rarely met with under 40 years of age, and not infrequently between 40 and 50, but most frequently between 50 and 60.

Semon's² experience with regard to age—stated in 1894—was that the 30 years of life between 40 and 70 furnished the majority of all cases of malignant disease of the larynx, and from 1894 to 1906 he found that more cases occurred in the decade between 60 and 70 than in that between 50 and 60.

The earliest case on record was reported by Rehn³ (Frankfurt); it was a child, aged three, with epithelioma of the larynx, which had existed for two years.

McBride⁴ records a case in a girl, aged twenty-four; Garel⁵ (Lyons) in a girl, aged eighteen; and Chiari⁶ (Vienna) in a girl, aged sixteen.

StClair Thomson⁷ found from the record of his first 10 cases of thyro-fissure for intrinsic cancer that the ages varied from 43 to 68. Five, or 50 per cent., were under 50, 4 were between 50 and 60, and 1 was nearly 70.

He has since reported⁸ two early cases of epithelioma of the larynx in patients (both males), aged respectively twenty-three and twenty-eight.

¹ *Montreal Med. Journ.*, May, 1899. Abstract, *Journ. Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 430.

² "Trans. Med. Soc. Lond.," 1907, xxx, p. 126.

³ "Virchow's Archiv.," 1868, xliii, p. 129; cited by Bosworth, "Dis. Nose and Throat," 1892, ii, p. 749.

⁴ *Med. Chronicle*, Feb., 1896, N.S. 4, p. 339.

⁵ *Ann. des Mal. de l'Oreille*, 1903, xxix, p. 377.

⁶ Cited by H. Marschik, *Monats. f. Ohrenheilk.*, 1909, xliii, p. 684.

⁷ *Brit. Med. Journ.*, 1912, i, p. 358.

⁸ "Proc. Roy. Soc. Med.," 1911, iv (Sect. Laryngol.), p. 119; *ibid.*, 1912, v, pp. 4 and 93; *ibid.*, 1912, v, p. 151; *ibid.*, 1913, vi, p. 16; *Journ. of Laryngol., Rhinol., and Otol.*, 1913, xxviii, p. 204.

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Butlin¹ mentions a case of sarcoma in a child of seven, believed to be congenital.

Hunter Mackenzie² refers to a case of epithelioma, of two years' existence, in a child of three, with microscopical examination by Virchow. This is the case recorded by Rehn (see p. 5).

Ziemssen³ records three cases under nine years of age, and three between ten and nineteen years.

Sex.—Females rarely suffer from cancer of the interior of the larynx; when they do exhibit cancer it is usually primary in the pharynx, and spreads to the larynx by continuity, and is then misleadingly recorded in the returns as extrinsic laryngeal cancer (William Hill).⁴ The male sex, however, is affected to the extent of about 90 per cent.

In Butlin's⁵ 50 collected cases, previously referred to, 40 were males, and but 10 females.

Semon,⁶ out of 212 cases of malignant disease of the larynx seen in his private practice in 25 years from 1878 to 1906, found that 177 occurred in men and only 35 in women.

In Gürlt's⁷ 63 cases—51 were males and 12 females.

Goris⁸ (Brussels) collected 62 cases, and found that out of these 55 occurred in men, 3 in women, and in 4 the sex was not stated.

¹ "Malignant Diseases of the Larynx," 1883, p. 8.

² *Journ. of Laryngol. and Rhinol.*, 1888, ii, p. 288. "Virchow's Archiv.," 1868, xliii, p. 129, and Butlin, "Malig. Dis. Larynx," 1883, p. 32.

³ *Cyclopædia of Med.*, 1877, vii. p. 891.

⁴ Personal communication to author.

⁵ *Op. cit.*, p. 31.

⁶ "Trans. Med. Soc. Lond.," 1907, xxx, p. 126.

⁷ Quoted by Price-Brown, "Dis. of Nose and Throat," 1901, p. 437.

⁸ *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 505.

CHAPTER II

CLASSIFICATION OF LARYNGEAL CANCER

KRISHABER¹ (Paris) divided malignant growths of the larynx into two groups according to the anatomical site of origin of the disease. *Intrinsic*—those arising from the cavity of the larynx: the true and false vocal cords, the ventricles, and the subglottic space. *Extrinsic*—those arising from other parts of the laryngeal mucosa, *i.e.*, the interarytænoid space, the aryepiglottic folds, the epiglottis, and the pharyngeal side of the larynx, which is, of course, a primary pharyngeal growth and not laryngeal in origin. In the same sense growths commencing on the pharyngeal side of the aryepiglottic folds and arytænoids and in the pyriform fossæ are pharyngeal in origin and only laryngeal by extension, and are wrongly recorded in returns *Mixed*—*i.e.*, a combination of extrinsic and intrinsic.

Semon² referred to the so-called intrinsic form as originating from what he termed the *true* interior of the larynx, *viz.* from the ventricular band downwards, and these are the only true laryngeal cancers, *i.e.*, primary in origin.

The intrinsic form, *i.e.*, true intra-laryngeal cancer, remains longer a purely local affection, owing to its location within a cartilaginous box from which the lymphatics have an attenuated connection with the glands in the neck, and not till the disease is much advanced are the neighbouring lymphatic glands infected.

¹ *Gaz. hebdomadaire*, 1879, xvi, p. 518.

² Discussion on the Operative Treatment of Malignant Disease of the Larynx, Seventy-first Ann. Meet. Brit. Med. Assoc. (Swansea), July 19, 1903. See *Brit. Med. Journ.*, 1903, ii, p. 115.

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In the extrinsic form—that arising, *i.e.*, primarily outside the larynx, but afterwards invading it from the pharynx—gland infection appears, as a rule, in the early stage, and metastasis more frequently occurs (Otto Stein, Chicago).¹

William Hill² has called attention to Krishaber's classification as unsatisfactory and confusing, in so far that no cancer arising in the larynx can anatomically be described as extrinsic in origin, though it may become so later by extension; for all primary laryngeal carcinomata are endolaryngeal in origin, and also at first in situation. He suggests that it would be more correct to divide them into:

(1) *Circumglottic Area Laryngeal Cancers*.—Growths which are wholly endolaryngeal in origin and remaining long intrinsic.

(2) *Party-wall Cancers*.—Rapidly invading growths, including those of intra-laryngeal, *i.e.*, intrinsic origin arising from the margin of the larynx and those of extra-laryngeal, *i.e.*, pharyngeal origin, and subsequently invading the larynx.

It is generally admitted, however, that for the purpose of differentiating those true endolaryngeal cancers, so long as they remain intrinsic and suitable for operation, by laryngofissure, from those which are laryngo-pharyngeal, the essential distinction which Krishaber had in mind is all that can be desired.

The classification of Fraenkel (Berlin), as modified by Moritz Schmidt³ (Frankfort), is a guide to the morphological varieties met with:

(1) The polypoid form on the vocal cord resembling a fibroma.

(2) The diffuse form on the vocal cord presenting a thickened irregular or nodular surface.

(3) Either of the above forms, or a combination of the two, situated elsewhere than on the vocal cords, and resembling more often a cauliflower-like growth.

¹ *Laryngoscope*, 1907, xvii, p. 266.

² "Proc. Roy. Soc. Med.," 1909, ii (Sect. Laryngol.), p. 3.

³ Quoted by Otto Stein, *Laryngoscope*, 1907, xvii, p. 269.

(4) The ventricular form.

(5) That form the origin of which is deep-seated.

Intrinsic Cancer Statistics.—Semon's¹ statistics of 212 cases of malignant disease between 1878 and 1906 showed that 136 were intrinsic and 76 extrinsic or mixed.

Chevalier Jackson's² statistics show that the more hopeful form, viz. intrinsic, is more frequent in the proportion of 98 to 43.

Rarity of Cancer of the Larynx in Women.—Whilst cancer of the larynx is very rare in women, the few cases which do occur in them are almost always of the extrinsic variety.

Semon's statistics show that the proportion of extrinsic and intrinsic cases were practically the reverse in the two sexes, viz. 124 of intrinsic and 53 of extrinsic in men against 12 cases of intrinsic and 23 extrinsic in women.

StClair Thomson³ has only performed thyro-fissure for epithelioma of the larynx in four females in comparison with thirty-four males.

Site of Intrinsic Cancer.—Primary endo-laryngeal cancer may originate at any point within the larynx, most commonly from the vocal cord. It tends to grow parallel to the long axis of the cord and involve it to a large extent before encroaching on other parts. It is rarely infra-glottic in origin.

Previous to the investigations of Semon,⁴ it had been assumed by writers that malignant disease comparatively rarely began in the vocal cords, but his experience showed that the cords were the parts most likely to be affected.

Paul Bruns⁵ (Berlin) collected 1100 cases of laryngeal neoplasms, of which 836 were on the vocal cords.

Schmiegelow⁶ (Copenhagen) also found that out of 66

¹ "Trans. Med. Soc. Lond.," 1907, xxx, p. 126.

² *Laryngoscope*, 1909, xix, p. 587.

³ "Trans. Med. Soc. Lond.," 1919, xliii, p. 105. *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, p. 147.

⁴ The Semon Lectures: P. McBride on "Semon's Work on Malignant Disease of the Larynx," *Journ. Laryngol., Rhinol., and Otol.*, 1913, xxviii, p. 179.

⁵ Cited by Shurley, "Dis. of Throat and Nose," 1900, p. 564

⁶ *Lancet*, 1914, ii, p. 300.

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cases of intra-laryngeal cancer at least 36 cases originated from the vocal cords.

Butlin¹ found, out of 50 cases of laryngeal cancer, that only 3 were subglottic.

Jonathan Wright² (New York) quotes the statistics of Fauvel, (Paris) which show that out of 300 cases of laryngeal neoplasms collected only 9 were subglottic.

Shurley³ (Detroit) has only met with 4 subglottic cases (subglottic in origin is probably meant) out of a total of 50.

Reports of cases demonstrate that intrinsic cancer may be situated on the surface of the cord and be confined to only a small portion, or it may invade a whole cord or ventricular band, or a diffuse deep infiltration may be present, which may only slowly approach the surface, or else having commenced on the anterior or middle third of one vocal cord it may extend to the anterior commissure and even invade the opposite cord, or, again, it may be found to have spread down into the subglottic space; or backwards to the posterior wall of the larynx.

StClair Thomson⁴ amongst 38 cases found the disease "chiefly subglottic" in 10 cases, and the disease recurred in the larynx or the glands in no less than 5 of these.

It is generally taught that intrinsic malignant disease of the larynx is most commonly situated on the posterior third of the vocal cord, and extends posteriorly and has a special preference for the posterior commissure, but experience during recent years has shown that the middle or anterior third is the favourite site, and that extension is more common along the anterior portion of the cord to the anterior commissure. This is confirmed by reference to cases reported by Semon,⁵ StClair Thomson,⁶ Tilley,⁷ Jobson Horne,⁸

¹ Quoted by Shurley, "Dis. of Throat and Nose," 1900, p. 572.

² *Ibid.*, p. 564.

³ *Ibid.*, p. 564.

⁴ *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, p. 149.

⁵ *Ibid.*, 1899, xiv, p. 130.

⁶ "Trans. Amer. Laryngol. Assoc.," 1914, p. 34.

⁷ *Brit. Med. Journ.*, 1898, ii, p. 1218. Abstract, *Journ. Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 48.

⁸ *Journ. Laryngol., Rhinol., and Otol.*, 1901, xvi, p. 283.

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Middlemass Hunt,¹ Barclay Barron,² Mollison,³ Chichele Nourse,⁴ Hett,⁵ Cathcart,⁶ and others.

The tendency for malignant disease to commence on the left vocal cord has been occasionally referred to by writers. Lennox-Browne found that cancer was more frequently left-sided, but Morell Mackenzie's statistics do not indicate a marked difference, the proportion of left to right-sided cancer being as 18 to 17. (Hunter Mackenzie.)⁷

Degree of Malignancy.—Some varieties of intrinsic cancer remain superficially limited for a long time, in their earlier stages, to one cord or ventricular band, and show no tendency or only a slow tendency to spread, this slow progress being seen chiefly in people of advanced age. It would appear that this occurs in certain epitheliomata with a preponderance of the fibrous element—probably the result of inflammatory reaction, Nature's first line of defence.

Clinical evidence suggests that there are various degrees of malignancy in epitheliomata, for in many cases a benign or feebly malignant clinical course may follow even when there is direct microscopical evidence of malignancy, whilst in others the growth may be of a rapid and highly malignant character.

Harmon Smith⁸ (New York) reports a case of laryngeal carcinoma where the malignant character was of such a low order that it ran a benign course for thirteen years before it became actively developed.

Duvivier⁹ (Paris) reported a case where the larynx was completely invaded by cancer. There was no trace of the vocal cords five months after the first appearance of symptoms, and at the post-mortem there was entire absence of secondary growths.

¹ *Journ. of Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 14.

² *Ibid.*, 1899, xiv, p. 5.

³ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Laryngol.), p. 97.

⁴ *Ibid.*, 1910, iii (Sect. Laryngol.), p. 143.

⁵ *Ibid.*, 1912, v (Sect. Laryngol.), p. 154.

⁶ *Ibid.*, 1918, xi (Sect. Laryngol.), p. 121.

⁷ *Journ. Laryngology and Rhinology*, 1888, ii, p. 288.

⁸ *Laryngoscope*, 1910, xx, p. 139.

⁹ *L'Echo Méd. du Nord*, April 29, 1900. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 444.

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Lennox Browne¹ suggested that the cause of such quiescence was probably to be found in the purely intrinsic nature of the disease, and the consequent absence of lymphatic infection, but this does not explain why some malignant growths in this position are more benign than others.

Infection by Contact.—Secondary disease of the opposite cord may occasionally occur by auto-infection. Shattock² says carcinoma is conveyable by contact to only a limited extent.

A few cases are recorded in which a malignant growth on one vocal cord has infected the opposite cord. Such cases have been reported by Newman,³ Butlin and Semon,⁴ Middlemass Hunt,⁵ Syme.⁶

The Transformation of Benign into Malignant Growths, especially in connection with Intra-laryngeal Operations.—Cases have been at various times recorded showing an *apparent* malignant degeneration of previously benign growths. Semon⁷ carried out important investigations in connection with this question, and reported in 1889 that out of 10,747 benign growths in 8216 cases (of which 3382 were papillomata) the growth was removed by intra-laryngeal operations, with 480 recurrences of the papillomata. Out of the whole number (10,747) that were at first benign, 45 became malignant whilst under observation, and of these 33 after intra-laryngeal operation. Degeneration occurred in 12 instances out of 2531 benign growths, in which no operation had been performed, so that the percentage of transformation was actually greater in the cases that were not interfered with intra-laryngeally than those in which operations were carried out.

¹ *Journ. of Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 179.

² Shattock and Dudgeon, "Wound Infection in Carcinoma," "Proc. Roy. Soc. Med.," 1915, viii (Path. Sect.), p. 63.

³ "Trans. Clin. Soc. Lond.," 1889, xxii, p. 101.

⁴ *Brit. Med. Journ.*, 1888, i, p. 96. Shattock, "Trans. Path. Soc.," 1888, xxix, p. 36.

⁵ "Proc. Roy. Soc. Med.," 1910, iii (Sect. Laryngol.), p. 34.

⁶ See Irwin Moore, "A Description of the more interesting specimens from the Pathological Museum of the 1st Annual Summer Congress of the Section of Laryngology, 1919." "Proc. Roy. Soc. Med.," 1920, xiii. (Sect. Laryngol.), p. 79.

⁷ *Internat. Centralblatt für Laryngologie*, 1889, pp. 271-289. Quoted by Barclay Barron, "Year Book of Treatment," 1891, p. 441.

CHAPTER III

DIAGNOSIS OF INTRINSIC CANCER OF THE LARYNX

Naked-eye appearance.—The diagnosis in the majority of cases should depend mainly on naked-eye appearances and on exclusion of other possibilities such as tuberculosis or syphilis. John Nolan Mackenzie¹ (Baltimore) says it is impossible to exaggerate the importance of naked-eye diagnosis in the detection of laryngeal cancer. Great assistance may also be obtained in some cases by direct laryngoscopy in ascertaining the extent of the disease.

Most epitheliomata of the interior of the larynx are in their early history superficial growths, but there are a few alleged exceptions which are believed to originate in the deep-seated tissues close to the perichondrium and do not approach the surface until a late stage of the disease. Such cancers occasionally give origin to a true papillomatous proliferation on the surface of the mucosa and closely resemble a perichondritis throughout the whole duration of the disease, so that the appearance is very often masked by the superadded symptom. If a portion of such a growth is removed endo-laryngeally for microscopical examination—unless the piece be large and deeply punched out, the result of the examination may prove misleading.

In some cases a granuloma may frequently be seen by the laryngoscopic mirror in the anterior commissure which suggests that perichondritis of the thyroid cartilage exists.

“Cancer of the ventricle of Morgagni very much resembles

¹ *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 525.

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internal perichondritis of the thyroid cartilage" (Moritz Schmidt).¹

Impaired mobility of the affected vocal cord, to which Semon² first drew attention, when present, is a valuable sign. It has been said to be pathognomonic of cancer of the vocal cord area, but this sign is not always present, and Semon did not assert that it was, for mobility is usually observed in surface growths in which only superficial infiltration has taken place. Impaired mobility is probably present in 50 per cent. of cases. The occurrence of immobility shows that the disease is more extensive than the laryngoscopic view of the growth would suggest, and that it has infiltrated deeply, and encroached on the intrinsic muscles, thus interfering with their action and with the free mobility of the crico-arytænoid articulation. This sign, which has been more exactly described as a "lagging" or "lazy" action of the vocal cord, when associated with hoarseness, should always arouse one's suspicions and awaken watchfulness (Leslie Davis).³ In any case, mobility does not exclude a diagnosis of malignancy.

Hoarseness.—A thorough laryngoscopic examination should always be made in all cases in which hoarseness persists, since alteration of the voice may be the earliest and only symptom of malignant disease. Chronic hoarseness in the aged is the most trustworthy early warning of possible malignancy, and may vary from a few months to some years.

Navratil⁴ (Pesth) reports a case of carcinoma of the larynx in which there was a history of hoarseness of ten years' duration. The growth at the end of that time was an ulcerated uneven mass as big as a walnut and involved the false and true cords. It was sharply marked off from the surrounding tissues, and there was no enlargement of glands.

Infiltration, persistent in character, is another strong clinical evidence of malignancy—many of these infiltrations

¹ "The Diagnosis of Laryngeal Cancer," *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 503.

² "Trans. Clin. Soc. Lond.," 1887, xx, p. 45.

³ *Laryngoscope*, 1908, xviii, p. 378.

⁴ *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 324.

have no sharp line of demarcation, but blend imperceptibly with the surrounding structures (Leslie Davis).¹

Laryngeal cancer may not only simulate tuberculosis, but also syphilis.

It is best to exclude, if possible, tuberculosis before thinking of syphilis or cancer (Jobson Horne).²

From tuberculosis it may generally be differentiated by the history, age, location, character of onset, and mode of development—together with evidence of disease in the lungs. From syphilitic gumma by the sudden appearance of the gummatous lesion, by its rapid development, and tendency to ulcerate and break down. There may also be a history of infection and the Wassermann test may be positive.

Obscure cases exist where there is the co-existence of two different diseases such as cancer and syphilis, or cancer and tuberculosis. Semon³ has reported this combination of cancer and tubercle.

Delavan⁴ (New York) refers to a case of malignant disease with catarrhal laryngitis and pulmonary phthisis.

Sokolowski⁵ (Warsaw) has recorded two cases of laryngeal cancer and pulmonary tuberculosis.

Hunter Mackenzie⁶ has met with an undoubted case of cancer accompanying tertiary syphilis of the larynx.

The appearance of malignancy in such cases known to have had tuberculosis or syphilis may be very misleading. This is well brought out in Otto J. Stein's article on the diagnosis between tuberculosis and syphilis, etc., in the *Laryngoscope*, 1907, xvii, p. 270, where he has summarised the forms of malignant lesions which present great difficulties in diagnosis :

- (1) A cancer arising deep in the tissues and presenting a

¹ *Laryngoscope*, 1908, xviii, p. 378.

² "The Differential Diagnosis of Tuberculosis, Syphilis and Malignant Disease of the Larynx." Paper read at the Seventy-fifth Ann. Meeting Brit. Med. Assoc. (Exeter), July, 1907. *Brit. Med. Journ.*, 1907, ii, p. 956.

³ St. Thomas's Hosp. Reports, 1883, xiii, p. 169.

⁴ *New York Med. Rec.*, May 2, 1885.

⁵ *Gazeta Lekarska*, 17 and 18, 1886. Cited by Hunter Mackenzie, *op. cit.*, p. 291.

⁶ *Op. cit.*, p. 291.

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vegetating mass of proliferating tissue that has the appearance of a papilloma.

(2) A round, smooth mass, situated in the ventricle of Morgagni, which may look like a perichondritis.

(3) A small malignant mass, situated deeply beneath the cords, and there may be some paresis present.

In forming an opinion as to the nature of the infiltration we should remember that :

Chronic laryngitis presents a bilateral hyperæmia and thickening.

Pachydermic laryngitis is a symmetrical affection located upon the vocal processes, an unusual site for malignant lesions.

Benign growths, as a rule, have no infiltration like the malignant ones, and grow towards the lumen and not into the tissues.

Endo-laryngeal Removal of a Portion for Microscopical Examination.—Difficulty in the diagnosis of certain cases of epitheliomata of the vocal cord may justify the removal of a piece through the natural passages for microscopical examination, but punching out a piece of the growth, if malignant, only stimulates and hastens the rapid increase and spread of the neoplastic area from the cord to the deeper structures, and the piece examined, not having been removed deep enough, may show no signs of malignancy, and no conclusion can be arrived at. Again, removal of a piece may expose the patient to the danger of auto-infection or metastasis. If the growth is of such a shape that a portion can be punched out through the whole thickness, this procedure is permissible (Delavan). To be certain of the diagnosis of malignancy, we must see in the sections epithelial cells, groups, or columns where one should not meet them. The irregular structure and arrangement of epithelium, such as we find in these groups, is the characteristic feature of cancer. It is seldom, however, possible to obtain a satisfactory specimen by means of forceps passed through the mouth, for the endo-laryngeal forceps do not remove the base from which the growth springs. It is wiser to perform thyro-fissure early in a case where malignant

disease is not absolutely established, as by this means the extent and nature of the disease can be accurately determined by naked-eye appearance and palpation, than to allow the case to progress until malignancy is absolutely certain and probably extended deeply (William Lincoln, Cleveland, Ohio).¹

Otto Stein² forms the following conclusions : "A negative find in a case clinically suspicious, or a suspicious case that cannot be disproved, should not, after explaining the matter to the patient, deter one from performing a thyro-fissure, even though it be but exploratory ; carefully and skilfully performed there can follow no harm."

¹ Discussion on Delavan's paper, "Recent Advances in the Treatment of Malignant Disease of the Larynx," "Trans. Amer. Laryngol. Assoc.," 1904, p. 170.

² *Laryngoscope*, 1907, xvii, p. 271.

CHAPTER IV

ENDO-LARYNGEAL EXTIRPATION

The Indirect Method of Laryngoscopy.—Since it is agreed that the successful extirpation of even the smallest growth depends upon free removal along with an area of healthy surrounding tissue, and it has been repeatedly shown, on opening the larynx, that the disease is more extensive and advanced than was previously suspected by laryngoscopic examination (Figs. 29 and 30), it is obvious that the endo-laryngeal route can never be efficient, and must always leave one in doubt as to whether the entire malignant deposit has been completely removed or not.

Arslan¹ (Padua) summarised reports of successful endo-laryngeal operations, sixteen in all, including two of his own, with freedom from recurrence lasting for twenty years.

Sendziack,² in 1907, stated that 50 per cent. of cases of laryngeal cancer were cured by laryngo-fissure compared with 46 per cent. by the endo-laryngeal method. He says that when recurrences were taken into account it would be found that 22 per cent. of the cases recurred after laryngo-fissure, 30 per cent. after partial or unilateral resection, and 33 per cent. after endo-laryngeal operations. This percentage of endo-laryngeal cures is, however, not supported by the statistics of other observers.

Finder³ (Berlin) considers that there is still a place for the endo-laryngeal removal of cancerous growth in certain very rare and carefully selected cases, and he refers to two cases—

¹ *Archiv. Italiano di Otologia*, 1901, xii, p. 389.

² *New York Med. Journ.*, 1907, lxxxvi, p. 1042; "Med. Annual," 1909, p. 401.

Journ. Laryngol., Rhinol., and Otol., 1910, xxv, p. 602.

one where the patient remained free from recurrence for three years, and another where the growth reappeared after eighteen years.

A few isolated cases have also been reported by Sendziak¹ (Warsaw), Fraenkel² (Berlin), Ingals³ (Chicago), StClair Thomson,⁴ Berens⁵ (New York), and others, where the growth has been entirely removed by the endo-laryngeal route, and no recurrence has taken place; but these were undoubtedly growths of superficial and limited extent, which were either localised to the edge of the cord or projected from the surface into the larynx. It is impossible to be successful where infiltration extends beyond the superficial tissues.

Chevalier Jackson⁶ says endo-laryngeal operation is contra-indicated, except in minute growths limited to the tip of the epiglottis, which are not strictly endo-laryngeal.

One great advantage of fissure of the larynx is that information may be obtained through direct inspection and palpation of the growth, which is not possible by the endo-laryngeal route, and there is no doubt whatever that this operation should be performed more frequently for exploratory purposes in doubtful cases, and it may be made the first stage of hemilaryngectomy or laryngectomy if permission has first been obtained from the patient to continue the operation if the growth is considered to be malignant. If the naked eye appearances are in favour of malignancy, or if there is any serious question of doubt, it should be made an invariable rule to go on with the operation.

The Direct Method by Suspension Laryngoscopy.—Clyde Lynch⁷ (New Orleans) refers to the removal of intrinsic epithelioma of the larynx by means of suspension laryn-

¹ *New York Med. Journ.*, November 30, 1907, p. 1042.

² *Deut. Med. Woch.*, xv, 1889; also *Arch. f. Laryngol.*, 1897, vi, p. 362.

³ *Laryngoscope*, 1907, xvii, p. 370.

⁴ "Intrinsic Cancer of the Larynx—Complete Excision apparently effected by Endo-laryngeal Operation," *Trans. Amer. Laryngol. Assoc.*, 1914, p. 34.

⁵ *Laryngoscope*, 1910, xx, p. 984.

⁶ "Peroral Endoscopy and Laryngeal Surgery," 1915, p. 438.

⁷ "A Résumé of my Year's Work with Suspension Laryngoscopy," *Ann. Otol., Rhinol., and Laryngol.*, 1917, xxvi, p. 308.

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gосcopy, and states that his experience has been exceptionally good, but that it is not large enough to reach definite conclusions. He says : " Dissection under suspension is not difficult, and can be done without permitting an instrument to touch the tumour mass." This procedure by endolaryngeal removal must, however, be condemned for the reasons previously stated.

CHAPTER V

THE OPERATION OF LARYNGO-FISSURE

THE brilliant results obtained during recent years by the operation of thyro-fissure in cases of early cancer of the interior of the larynx, more especially in the vocal cord area, have brought this comparatively old operation more prominently to notice.

An anterior median vertical fissure of the larynx may include fissure of the thyroid or cricoid cartilages, or of both. Fissure of the cricoid alone is probably a very rare procedure. In the treatment of chronic inflammatory stenosis of the larynx a full laryngo-fissure through the thyroid and cricoid cartilages is always performed, and usually the incision extends through some rings of the trachea, thus constituting a laryngo-tracheostomy or tracheo-laryngostomy. In operations for malignant disease, and in very exceptional forms of non-malignant disease, the lesser form of laryngo-fissure—*i.e.* thyro-fissure—is the operation of choice, the cricoid being left intact. This shorter form of laryngo-fissure is frequently alluded to as thyrotomy, and that nomenclature was not only employed by Butlin and Semon in recording their numerous cases, but their example has been largely followed by specialists and general surgeons all over the world.

Thyrotomy as a term is not free from ambiguity, however, and does not differentiate between incising the thyroid gland and the thyroid cartilage. The same criticism in a lesser degree applies to thyro-fissure. Timothy Holmes,¹ in

¹ "Trans. Med. Chir. Soc.," 1882, lxxv. p. 177.

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1882, suggested it might be better termed "chondro laryngotomy." or "total laryngotomy."

Durham,¹ in 1883, expressed his opinion that the term "thyrotomy," is more applicable to cutting operations on the thyroid gland, and suggested that any operation in which section of one or other or both of the larger laryngeal cartilages is made should be termed "laryngo-chondrotomy." For the sake of clearness, Tilley² has both spoken and written of thyro-chondrotomy instead of thyrotomy.³ Hill, in discussion, has suggested that laryngo-fissure should be retained for the full incision where both cartilages are fissured (which is occasionally necessary in cases of considerable sub-glottic extension of the lesion), and thyro-chondro-fissure adopted for the shorter form of laryngo-fissure.

For the title of this paper I have employed the term "laryngo-fissure" in its old comprehensive sense as including both the longer and shorter incisions. The main part of the paper is concerned with the lesser variety of laryngo-fissure, and this I have alluded to as "thyro-fissure," a term which is less ambiguous than thyrotomy and quite well understood.

History and Statistical Results of the Operation of Laryngo-fissure.—The operation of dividing the larynx by section of the cartilages for the removal of growths and foreign bodies dates back over three-quarters of a century, twenty-two years before the introduction of laryngoscopy in 1855, though it was seldom performed before that date on account of the great difficulty of making a definite diagnosis.

The operation was first suggested and strongly recommended by Desault⁴ (Paris) in 1812 for the removal of laryngeal growths, though it was never actually carried out by him. Its origin has been wrongly attributed by Richard-

¹ Holmes's "System of Surgery," vol. i, 1883, p. 768.

² *Brit. Med. Journ.*, 1898, vol. ii, p. 1218; also "Proc. Roy. Soc. Med.," 1915, ix (Sect. Laryngol.), p. 48.

³ "Proc. Roy. Soc. Med.," 1914, viii (Sect. Laryngol.), p. 35.

⁴ "Œuvres Chirurgicales par Bichat," Paris, 1812, ii, p. 255. Quoted by Durham, "On the Operation of Opening the Larynx by Section of the Cartilage," "Trans. Med. Chir. Soc.," 1872, lv, p. 17.

son (Washington)¹ to Sanger (Berlin). To Brauers² (Louvain) belongs the credit of having first performed the operation of thyro-fissure in 1833 on a male aged forty for papillomatous growth of the larynx, which he cauterised. No tracheotomy tube was used, the thyroid cartilage only was divided, and the patient survived the operation for twenty years.

This case was remarkable in the correctness of the diagnosis without the aid of the laryngoscope, and the fact that the operation was performed without a preliminary tracheotomy and without the aid of anæsthesia—a most brilliant achievement.

Ehrmann³ (Strasburg), ten years later, in 1844, removed a papillomatous growth by this route in a female aged thirty-three. He first performed a preliminary tracheotomy, followed forty-eight hours later by a complete laryngofissure, the tube being removed the following day. The patient was placed in an arm-chair with the head well extended and held—no anæsthetic being used—and is said to have submitted to the operation “with much calmness and courage.” The wound was brought together by adhesive plaster, and healed in twenty-one days. The patient unfortunately died six months later from typhoid fever. Ehrmann must, therefore, share with Brauers the honour and credit of having initiated this operation.

To Gurdon Buck⁴ (New York) belongs the honour of being the first surgeon in the United States to perform this operation, also the first to carry it out for a malignant growth of the larynx. In 1851, he operated on a malignant growth by this method in a female aged fifty-one. Both the thyroid

¹ Discussion on StClair Thomson's paper, “Intrinsic Cancer of the Larynx,” *Trans. Amer. Laryngol. Assoc.*, 1914, p. 40.

² *Journ. de Gräfe et Walther*, 1834, xxi, p. 534. Quoted by Ehrmann, “*Histoire des Polypes du Larynx*,” 1834, p. 12. Quoted by Durham, *op. cit.*, pp. 30 and 69.

³ “*Laryngotomie dans un cas de Polype du Larynx*,” Strasburg, 1844. Horace Green, “*The Surgical Treatment of Polypi of the Larynx*,” 1852, p. 47. Durham, *op. cit.*, p. 67.

⁴ “*Trans. Amer. Med. Assoc.*,” 1853, vi, p. 510. Mackenzie, “*Growths in the Larynx*,” pp. 89 and 92. Quoted by Sands from “*St. Luke's Hosp. Reports*,” *New York Med. Journ.*, May, 1865. Durham, *op. cit.*, p. 76.

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and cricoid cartilages were divided. The growth, which was an epithelioma, was extensive, and was not entirely removed, two subsequent operations being performed, and death occurred fifteen months later. A tracheotomy tube was inserted and retained to the last. The operation was performed without any anæsthetic. The patient, who was seated on a low chair before a window with the head extended and the front legs of the chair raised 3 in. upon blocks, is said to have "displayed the most remarkable courage throughout this very difficult and protracted operation," which was delayed forty-eight hours between the tracheotomy and laryngo-fissure until the patient had recovered from the fatigue and exhaustion of the first operation.

These cases occurred before the general use of the laryngoscope, the introduction of which caused the operation to grow rapidly in favour.

This surgeon again, in 1862,¹ performed a thyro-fissure for a papillomatous growth in a male aged twenty-five, preceded some time previously by a tracheotomy; also in 1870² a laryngo-fissure for papilloma in a patient aged thirty-eight. An urgent tracheotomy was performed without any anæsthetic. The tube was removed in three months.

Rauchfuss³ (Petrograd), in 1861, opened the larynx in a woman for the removal of an extensive sarcomatous growth, both the thyroid and cricoid cartilages being divided, also the upper part of the trachea—a tracheotomy tube being inserted. The growth was incompletely removed, and extended rapidly, the patient dying two years later of gangrene of the lung. The tube was retained to the last. In the history of this case there is no mention of any anæsthetic.

He was thus the first surgeon in Europe to remove a growth from the larynx which had been diagnosed with the laryngoscope (six years after its introduction) by means of laryngo-fissure.

¹ Cited by Duncan Gibb, *Brit. Med. Journ.*, 1865, ii, p. 328.

² "Trans. New York Acad. Med.," 1870, iii, pt. 10. Durham, *op. cit.*, p. 61.

³ *St. Petersburg Medizin. Zeitsch.*, 1862, iii, p. 153; and 1865, vi, p. 43. Durham. *op. cit.*, p. 82.

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H. B. Sands¹ (New York), in 1863, performed the operation on a female, aged thirty, for carcinoma of the larynx, which originated from the left ventricle, and this is the first case recorded in the United States where the diagnosis of malignancy was made with the laryngoscope (by sunlight) previous to this operation being performed. The thyroid isthmus was first divided and a median tracheotomy performed—the thyroid and cricoid cartilages being afterwards divided, and the tube removed on the fifth day. Patient died twenty-two months later of cancer of the kidney without any recurrence in the larynx. Ether was used as an anæsthetic with the patient lying down and the head well extended. No gauze or sponge packing was used in the trachea above the tracheotomy tube (which was an ordinary one), and the wound was closed by sutures.

This case is specially interesting as it is the first one recorded where laryngo-fissure was performed under ether inhalation since the introduction of this anæsthetic by Morton in 1846.

Boeckel² (Strasburg), in 1862, carried out a laryngo-fissure with preliminary tracheotomy for syphilitic stenosis, and Busch³ (Bonn) also in the same way for a syphilitic growth, the cannula being continuously worn. In the first case the patient is said to have “suffered greatly” from the operation and succumbed to inflammation of the lungs three months later. No anæsthetic was used in either case.

In 1864 Ulrich and Lewin⁴ (Berlin) and Gilewski⁵ (Cracow) performed thyro-fissure for papilloma, and Debrou⁶ (Orleans) for a fibrous growth. In the first case chloroform was used, and the wound was brought together by strips of plaster.

¹ *New York Med. Journ.*, 1865, i, p. 110. Durham, *op. cit.*, p. 40.

² “Mémoires de la Société de Chirurgie de Paris,” 1863, iv, p. 537. Durham, *op. cit.*, p. 70.

³ Extrait de la *Thèse de Swebel*, Strasburg, 1866. “Beobachtungen zur innern Klinik,” von Carl Binz, Bonn, 1864, p. 108. Durham, *op. cit.*, p. 75.

⁴ *Wiener Med. Woch.*, 1865, xv, p. 147. *Berlin Klin. Wochenschr.*, Dec., 1864, i, p. 509. *Brit. Med. Journ.*, 1865, i, p. 253. Durham, *op. cit.*, p. 42.

⁵ *Wiener Med. Woch.*, 1865, xv, p. 933. *Brit. Med. Journ.*, 1865, ii, p. 333. Durham, *op. cit.*, p. 46.

⁶ *Gazette Hebdomadaire*, 1864, i, p. 347. Durham, *op. cit.*, p. 88.

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This is the first record of thyroid fissure having been performed under chloroform anæsthesia since its introduction by Simpson in 1847. In the second case chloroform was also used, whilst in the third case no anæsthetic is mentioned. Debrou was the first to record a case where the thyroid cartilage only was divided, *i.e.* a thyro-fissure performed, since Brauer's original case in 1833. It is interesting to note that all four operators diagnosed their cases by the laryngoscope, and performed a preliminary tracheotomy or laryngotomy, with the exception of Gilewski, who used no tube; the first two performed a laryngo-fissure, and the latter two a thyro-fissure.

Duncan Gibb,¹ in 1864, was the first to bring to the notice of the profession in this country the subject of thyrotomy for the removal of morbid growths when he performed a laryngo-fissure and removed an epithelioma in a female, aged twenty-nine, the thyroid and cricoid being divided, preceded eight days previously by a tracheotomy. The case was diagnosed by the laryngoscope. The patient died one year later of recurrence, the tube being retained all the time. The operation was performed under chloroform anæsthesia, no gauze or sponge packing was used above the tracheotomy tube, and the wound was brought together by two metallic sutures. Patient was sitting up on the fifth day, and eating heartily by the fourteenth. Duncan Gibb comments on this case as follows: "Although perhaps the operation, at first sight, seems to be formidable, it ought to be one of the simplest performed upon the neck." He also expresses the opinion that tracheotomy much simplifies the proceeding.

Gouley² (New York), in 1865, under chloroform opened the larynx of a child, aged six, for papilloma, by laryngo-fissure with a preliminary tracheotomy, the operation being repeated nine months later for recurrence. The tube was removed three months after the second operation.

Koeberle³ (Strasburg), in 1865, performed a thyro-

¹ *Brit. Med. Journ.*, 1865, ii, p. 327. Durham, *op. cit.*, p. 78.

² *New York Med. Journ.*, 1867, v, p. 473. Durham, *op. cit.*, p. 44.

³ *Thèse de Swebel*, Strasburg, 1868. Durham, *op. cit.*, p. 73.

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fissure in a patient, aged fifty-seven, for a condylomatous growth. The internal surface of the thyroid cartilage was exposed, and the right vocal cord removed. A laryngotomy tube was still being worn seven months after.

Balassa (Pesth), between 1865 and 1868, performed three laryngo-fissures and one thyro-fissure in patients whose ages varied from 19 to 44. Three cases were papilloma¹ and one sarcoma.²

Tracheotomy was performed in each case. No reference was made to the anæsthetic used.

L. VOSS³ (New York), in 1866, had a similar case of tracheotomy and laryngo-fissure, in which he also re-operated six months later.

Arthur E. Durham,⁴ in 1866, performed his first operation on a child, aged thirteen, for papilloma. Tracheotomy had been performed four years previously. He divided both thyroid and cricoid cartilages in order, as he says, "to obtain sufficient room." The tube was removed on the tenth day after the laryngo-fissure operation.

Ephraim Cutter⁵ (Boston) in 1866 carried out a thyro-fissure in a female, aged twenty-eight, for a large sessile fibrous growth. The operation was performed under ether with the patient sitting up in a chair. No tracheotomy tube was used. The report of this case⁶ twenty years later showed that there was no recurrence and phonation was perfect. In 1867⁷ he performed his second thyro-fissure for a large epitheliomatous growth, in a patient aged fifty-six, which recurred sixteen months later. He is said to have been the first surgeon to perform this operation without recourse to

¹ *Wiener Med. Woch.*, November 11, 14 and 18, 1868. Durham, *op. cit.*, pp. 47, 49, 51.

² *Wiener Med. Woch.*, November 14, 1868. Durham, *op. cit.*, p. 53.

³ Voss, by private letter to Arthur E. Durham, "Trans. Med. Chir. Soc.," 1872, lv, p. 87.

⁴ "Trans. Med. Chir. Soc.," 1872, lv, p. 18. "Guy's Hosp. Reports," 1866, xii, p. 540.

⁵ *Am. Journ. Med. Sci.*, 1867, liii, p. 138.

⁶ *Archiv. Laryngol.*, 1882, iii, p. 362. "Trans. Amer. Laryngol. Assoc.," 1917, p. 350.

⁷ *Boston Med. and Surg. Journ.*, 1869, iii, p. 37. Durham, *op. cit.*, p. 63.

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tracheotomy. This, however, is not correct, for Ehrmann has definitely placed on record the case of Brauer's in 1833, also there is the case of Gilewski in 1864.

Timothy Holmes,¹ in 1867, performed laryngo-fissure on a child, aged nine, for papilloma, preceded by a preliminary tracheotomy. The cannula had to be persistently worn. Also in the same year Long² (Liverpool) refers to a similar case.

Morell Mackenzie,³ in carrying out his first operation of thyro-fissure in 1868 on a lady, aged sixty-six, for papilloma, used only local anæsthesia, a preliminary tracheotomy being performed. This is the first recorded case where a local anæsthetic was used; and the author is indebted to Mark Hovell for the information that anhydrous sulphuric ether was used by means of a spray (Richardson's) projected on to the neck so as to cause local freezing. Morell Mackenzie also refers to another case in 1869 of epithelioma in which tracheotomy was performed two weeks before the thyro-fissure; the growth was only partially removed, with recurrence, and death seven months later.

Two other cases of thyro-fissure were reported by Pugin Thornton⁴ from the Golden Square Hospital in 1872. One patient, aged twenty-four, suffered from epithelioma, preliminary tracheotomy was performed, but the patient only survived ten months. Another patient, aged two and a half years, also suffered from papilloma. In this case also a preliminary tracheotomy was performed.

Navratil⁵ (Pesth), in 1868, had three cases of papilloma, ages varying from 20 to 30. In one he performed laryngo-fissure and in two thyro-fissure. In one case no tracheotomy was performed, and one thyro-fissure was performed under local anæsthesia of ether.

¹ "Surgical Treatment of Children's Diseases" (2nd edition), London, 1869, p. 311. Durham, *op. cit.*, p. 84.

² "Liverpool Hosp. Reports," 1867, p. 9. Durham, *op. cit.*, p. 28.

³ "Growths in the Larynx," 1871, pp. 166 and 183. Durham, *op. cit.*, pp. 54 and 80.

⁴ *Brit. Med. Journ.*, 1873, i, p. 460. "Trans. Clin. Soc. Lond.," 1872, pp. 90 and 92.

⁵ *Berlin Klin. Woch.*, December 7, 1886, pp. 501, 502. Durham, *op. cit.*, pp. 57 and 85.

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Solis Cohen¹ (New York), in 1868, having seen Cutter operate, himself performed a thyro-fissure, preceded by tracheotomy, for a fibroid growth.

Then followed Krishaber² (Paris) in 1869 with a thyro-fissure without tracheotomy for a papilloma originating from the right ventricle of Morgagni in a patient aged thirty-eight. The operation was performed with the patient lying in bed, without an anæsthetic, and to assure himself of the integrity of the vocal cords before the thyroid cartilage was closed, the operator told the patient to sing over the scale—showing everything normal.

Schrotter³ (Vienna) performed the same year preliminary tracheotomy and laryngo-fissure for extensive carcinomatous disease—"great difficulty being experienced in dividing and separating the thyroid and cricoid cartilages on account of their ossified condition." Death occurred eleven days later from blood poisoning.

Denuce⁴ (Bordeaux), in 1870, performed this operation on a patient, aged fifty-four; also Ogle and Lee⁵ at St. George's Hospital in 1871 for papilloma in a child, aged five; and Langenbeck⁶ (Berlin), in 1871, a laryngo-fissure and tracheotomy for a subglottic epithelioma in a male, aged twenty-eight.

Arthur E. Durham⁷ and his colleagues Bryant and Davies-Colley at Guy's Hospital, between 1862 and 1872, performed five of these operations for papilloma in children whose ages varied from three to nine years.

In 1870,⁸ Durham collected together 138 cases of new

¹ *New York Med. Record*, August, 1869. Solis-Cohen, "Diseases of Throat," 1872, p. 445. Virchow's "Jahresbericht" (Berlin), 1870, Bd. iii, p. 117. Durham, *op. cit.*, p. 55.

² *Med. Times and Gazette*, 1869, November 20, p. 596. *Gazette des Hôpitaux*, No. 103, 1869. Durham, *op. cit.*, p. 58.

³ *Medizinische Jahrbucher*, Wien, 1869, xvii, Heft 2, p. 81. Virchow's "Jahresbericht," Berlin, 1870, vol. ii. Durham, *op. cit.*, p. 88.

⁴ Denuce, *Bordeaux Médicale*, February 15, 1872. Quoted by Morell Mackenzie, *Brit. Med. Journ.*, 1873, i, p. 459.

⁵ Durham, *op. cit.*, p. 28.

⁶ *Brit. Med. Journ.*, 1871, ii, p. 529. Durham, *op. cit.*, p. 66.

⁷ "On the Operation of Opening the Larynx by Section of the Cartilages for Removal of Morbid Growths," "Trans. Med. Chir. Soc.," 1872, lv, p. 17.

⁸ Holmes's "System of Surgery," 2nd edition, 1870, iv, p. 584.

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growths of the larynx, and compared those removed through the mouth and natural passages, numbering 114, with 24 removed by external fissure of the larynx. Amongst the former, 94 were completely successful, 17 partially successful, and 3 died; whilst among the latter, 15 were completely successful, 5 partially successful, and 4 died. Out of the total number of growths, only 5 were malignant, whilst out of the 7 fatal cases following operation, 5 were malignant.

In 1872, he published¹ in considerable detail all the cases he could find recorded up to that date in which the thyroid cartilage had been divided for the removal of morbid growths, and found that they were 32 in number, excluding the 5 performed by himself or colleagues at Guy's Hospital between 1862 and 1872. Reference to these cases has been freely made in compiling the history of this operation. Out of a total of 37 cases; so far as the operation of thyrotomy was concerned, it was successful or partially so in 31, temporarily beneficial in 4 which were cancerous, and only 2 deaths were more or less directly due to the operation itself. It will be observed that during this period there was no discrimination whatever in the choice of cases—the majority being performed for papillomatous growth.

Thyro-fissure for papilloma is not nowadays employed on account of repeated recurrence; direct laryngoscopy and endoscopic removal have taken its place.

Semon² reports the case of a patient in whom thyro-fissure was performed 17 times for papilloma with failure to cure.

Morell Mackenzie,³ in 1871, also summarised all the cases of thyrotomy—28 in number—performed up to 1869, of which only 6 were malignant, and he compared the merits of this operation in relation to life and recurrence of growth with 100 consecutive cases he had treated endo-laryngeally—of which 96 were benign. He states that in the 28 cases of thyrotomy (of which 6 were malignant) there was recur-

¹ "On the Operation of Opening the Larynx by Section of the Cartilages for the Removal of Morbid Growths," "Trans. Med. Chir. Soc.," 1872, lv, p. 17.

² "Proc. Laryngol. Soc. Lond.," 1894, p. 62.

³ "Growths in the Larynx," 1871, pp. 92 also 210-223.

rence in 6 cases and 9 patients died, whilst not one of the 96 benign cases treated through the natural passages terminated fatally, and recurrence took place in only 6 cases. Out of the total 100 cases, only 4 were malignant and 2 terminated fatally. Thyrotomy was performed in 3 of these cases, 1 being malignant, and death followed eight months after operation, this being the only case amongst the 3 thyrotomies which had a fatal termination.

Later, in 1873,¹ he republished these statistics along with other cases recorded up to date, 48 in all, of which 7 were malignant. He states that of these, absence of recurrence occurred in only 14·58 per cent. of cases, whilst recurrence occurred in 22·91 per cent., and death from operation in 8·33 per cent.

Morell Mackenzie described the operation as a very serious one as regards danger to life and destruction of function of the voice.

Timothy Holmes² also expressed the opinion that it was a very serious surgical procedure and ought to be reserved for cases of proved necessity.

Salzer³ (Vienna) refers to Billroth (Vienna) as having, between 1870 and 1884, performed laryngo-fissure on 8 cases of laryngeal cancer—in 1 there was no recurrence after two years and nine months, in another case the after-history was wanting, and the other 6 died of recurrence.

Chiari,⁴ refers to Billroth as having performed, in eighteen years between 1870 and 1888, ten laryngo-fissures for laryngeal cancer. Death followed operation in 3 cases (3 per cent.), recurrence in 4 (40 per cent.), whilst there were only 3 cures (30 per cent.).

Paul Bruns⁵ (Berlin), in 1878, published an account of

¹ "Dis. of Throat and Nose," 1880, i, p. 327. "The Results of Thyrotomy for the Removal of Growths from the Larynx," *Brit. Med. Journ.*, 1873, i, pp. 458 and 486.

² *Brit. Med. Journ.*, 1873, i, p. 531.

³ Salzer, Langenbeck's *Arch. f. Klin. Chirurgie*, 1885, xxxi, p. 848. Quoted by StClair Thomson, "Dis. of Nose and Throat," 1916, p. 492.

⁴ Chiari, "Trans. Amer. Laryngol. Soc.," 1909, p. 20.

⁵ "On the Relative Merits of Endo-laryngeal Treatment and Thyrotomy," Berlin, 1878, p. 73.

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19 cases of malignant disease treated up to that time by thyrotomy, which showed that the results were most unsatisfactory. Two patients died shortly after the operation, local recurrence occurred in 14 immediately, or a few months, after operation—in 1 case there was recurrence in one year—and in 1 case death occurred twenty-two months after operation from cancer of the kidney, whilst there was no trace in the larynx itself. The results were not reported in 3 cases. Summary—only 2 survived a year.

Bruns drew the following conclusion: "That the attempt at radical extirpation of cancer by means of thyrotomy has proved itself completely unsatisfactory and worthless."

These bad results were due partly to the operation being performed in advanced and unsuitable cases, and partly to faulty technique. Again, this operation was performed in many cases by the general surgeon and not by the experienced and skilled laryngologist. In these early days the majority of cases died from causes directly attributable to the operation and its sequences, such as septic pneumonia or bronchitis. In consequence of Bruns and others denouncing thyro-fissure, during the following ten years, *i.e.*, from 1878 to 1888, the operation was almost abandoned in favour of laryngectomy, and only 11 cases of laryngeal cancer were treated by thyro-fissure (Semon).¹

The position of malignant disease of the larynx during this decade may be gathered from the opinion expressed by J. Nolan Mackenzie² (Baltimore), in 1906, when looking back on the work at the Golden Square Throat Hospital in the seventies and early eighties of last century. He says: "There was but one disturbing and discordant memory in the treatment of cancer of the larynx, *viz.*, the piecemeal removal of the growths through the natural passages which to-day would be considered as a means of slow death. The growth was stimulated at once into much quicker activity, the patient naturally became much worse, and was sent to

¹ Cited by Shurley, "Dis. of Throat and Nose," 1st. Edit. 1900, p. 593.

² *Ann. Otol., Rhinol., and Laryngol.*, March, 1906, xv, p. 61.

his long home much earlier than if he had been left severely alone. There was never a thought of a cure."

The first great exponent of this operation was Arthur Durham, and if his advice and experience had been followed in place of the condemnatory opinions of Bruns, Billroth, and Morell Mackenzie, this operation would not have fallen into such complete abeyance and discredit until revived by Butlin and Semon in 1890; for Durham,¹ as long ago as 1872, in referring to this operation, remarked: "A just estimate of the general and special merits of the operation of opening the larynx by section of the cartilages in order to facilitate the removal of morbid growths can only be obtained by personal experience, or by the careful study of the recorded experience of others," and he had come to the following conclusions, viz., "that the danger and difficulties attending it are neither so numerous nor so considerable as have been represented and commonly supposed, and that the success hitherto achieved has been so marked and so indisputable as to justify and encourage in any such cases as may seem appropriate, an earlier, bolder, and more ready resort to this method than has hitherto prevailed."

Butlin, in 1883,² collected together from various sources 50 cases of carcinoma and 23 of sarcoma of the larynx; of the latter, 17 were intrinsic, 3 were extrinsic, and 3 of uncertain origin. He referred to the cases collected by Morell Mackenzie and treated by endo-laryngeal methods, and considered that too favourable a view had been taken of these cases. At this time Butlin's opinion inclined towards hemi-laryngectomy and laryngectomy, as shown by the following views: He says "not the slightest encouragement is afforded by published accounts to induce one to perform the operation of thyro-fissure, or the sub-thyroid incision, for the removal of carcinoma whether extrinsic or intrinsic." He also remarks that "malignant disease of the larynx does not appear to infiltrate so deeply or spread so rapidly, and it usually runs its course without affecting the lymphatic

¹ "Trans. Med. Chir. Soc.," 1872, ix, p. 38.

² "Malignant Dis. of the Larynx," 1883, pp. 57-63.

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glands. It, is, therefore, amenable to treatment by complete removal of the part from which it grows, which may necessitate partial or complete eradication."

Semon,¹ in 1886, drew attention to some important points in the practical diagnosis of *early* malignant diseases of the larynx, which resulted in Butlin recommending that thyro-fissure should be reinstated in its place.

Butlin² first began to perform thyro-fissure for cancer of the larynx in 1886, and from 1890 he confined himself entirely to intrinsic cases. Up to 1890 he had performed ten operations on nine patients conjointly with Semon, of whom one-third died of the operation, one-third of recurrence, and in the remaining third sufficient time had not elapsed since operation to claim success.

Butlin, between 1886 and 1894, operated on 14 cases, of which 2 (14·3 per cent.) died from the operation, 6 recurrences (43 per cent.) occurred, whilst there were 6 cures (43 per cent.), made up of 3 relative and 3 definite cures³ (Chiari).⁴ Between 1890 and 1907⁵ he had performed 23 thyro-fissures on 21 patients, with only 1 death, 10 of which cases were quite successful.

Delavan⁶ (New York), in referring to the general statistics up to 1904, says that permanent cures were as high as 44 per cent., while the death-rate could be placed at about 11 per cent. He finds, however, that nearly 70 per cent. of Butlin's cases lived for more than 3 years after operation, whilst his deaths from operation were 9·5 per cent.

Butlin lost no case from operation after 1899.

Semon⁷ first carried out this operation independently of Butlin in 1891. Between 1886 and 1896 he had operated on

¹ "Trans. Clin. Soc. Lond.," 1887, xx, pp. 45, 54. Also Heath's "Dict. Pract. Surg.," 1886, i, p. 895.

² "Trans. Med. Soc. Lond.," 1907, xxx, p. 140.

³ *Relative cure*, i.e., no recurrence for one year. *Definite cure*, i.e., no recurrence after three years.

⁴ Chiari, "Trans. Amer. Laryngol., Rhinol., and Otol. Soc.," 1909, p. 20.

⁵ "Trans. Med. Soc. Lond.," 1907, xxx, p. 141.

⁶ "Trans. Amer. Laryngol. Assoc.," 1904, p. 155.

⁷ "Trans. Med. Soc. Lond.," 1907, xxx, p. 140. *Laryngoscope*, 1903, xiii, p. 887.

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8 cases, of which 2 (25 per cent.), died from the operation ; there were 2 (25 per cent.) recurrences and 5 cures (62·5 per cent.), made up of 50 per cent. relative and 12·5 per cent. definite cures.¹ Between 1891 and 1904 he had operated on 20 cases, of which 1 died from operation (5 per cent.), and 2 recurrences occurred (10 per cent.), whilst his cures showed an increase to 17, *i.e.*, 85 per cent. were well (Chiari).²

In 1907 Semon³ had operated on 33 cases (25 cases being of undoubted malignancy), and his results showed a "lasting cure" in 80 per cent. There were 13·6 per cent. recurrences with 8·8 per cent. fatal results. Semon's last fatal case from operation was in 1894.

The period since 1890, owing to the diagnostic skill of Semon and the operative skill and technique of Butlin, was one in which great advances were made, resulting in this operation being reinstated in its proper place.

Sendziak⁴ (Warsaw), reviewed, in 1897, the general statistics of laryngo-fissure, and showed that out of 85 cases (92 laryngo-fissures) operated on between 1851 and 1894 9 (9·8 per cent.) deaths followed the operation ; there were 49 (53·3 per cent.) recurrences, insufficient observation in 8 cases (8·7 per cent.), and cure in 21·7 per cent., made up of 13 per cent. relative and of 8·7 absolute cures. Delavan,⁵ in revising these statistics, gives the period as between 1876 and 1894. Again, in 1899, Sendziak reviewed 136 cases from 1851 to 1907, which showed 25 per cent. of cures. Later, in 1908, he refers to 214 cases, from 1888 to 1907, which showed 50 per cent. of cures, the death-rate from operations falling from 9·8 per cent. to 2·4 per cent.

Schmiegelow⁶ (Copenhagen), in 1897, collected the statistics of 49 cases of laryngo-fissure between 1890 and 1896, amongst which 7 deaths (14·3 per cent.) occurred from

¹ *Archiv. für Laryngol.*, 1897, vi, p. 375.

² " *Trans. Amer. Laryngol., Rhinol., and Otol. Soc.*," 1909, p. 20.

³ " *Trans. Med. Soc. Lond.*," 1907, xxx., p. 127.

⁴ Cited by Chiari, *op. cit.*, 1909, p. 21.

⁵ *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 651.

⁶ *Ann. des Mal. de l'Oreille, etc.*, 1897, xxiii, April. Cited by Chiari, " *Trans. Amer. Laryngol., Rhinol., and Otol. Soc.*," 1909, p. 21. Cited by Delavan, *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 651.

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operation, and recovery took place in 56 per cent. of these cases, made up of relative recovery in 21 cases (42·6 per cent.) and definite recovery in 7 cases (14·3 per cent.). Recurrence occurred in 14 (28·5 per cent.) cases.

Clinton Wagner¹ (New York), in 1900, reported 15 thyro-fissures, 4 of which were malignant; 5 of these patients were then living at periods of 1 year, 12 years, and 17 years respectively; of those not then living, one survived 2 years, one 3 months, and one 10 weeks, and in none of these cases was death due to the operation of thyro-fissure. The name of Clinton Wagner has been linked with that of Butlin in considerably developing and simplifying the method of performing this operation.

D. Bryson Delavan² (New York), in 1900, collected the statistics of laryngo-fissure in the case of 7 operators, viz.: Von Bergmann (Berlin), Kocher (Berne), Mikulicz (Breslau), Butlin, Chiari (Vienna), Schmiegelow (Copenhagen), and Semon, and found that out of 50 cases there were 9 deaths from operations (18 per cent.), 39 (78 per cent.) (result of 2 cases not reported) recovered from the operation, whilst 6 (12 per cent.) died from pneumonia, 9 (18 per cent.) from recurrence, and 1 (2 per cent.) from sepsis; 16 (32 per cent.) were well over 2 years.

Chiari,³ in referring to these statistics, gives 35 recoveries (70 per cent.) made up of 23 (46 per cent.) relative recoveries, and 12 (24 per cent.) definite recovery.

Frank Hartley⁴ (New York), in 1902, reviewed the literature of thyro-fissure, partial laryngectomy and total laryngectomy from 1832 to 1902. He showed from statistics that earlier diagnosis and more restricted operative procedures gave promise of a greater reduction in the death rate and in the possibility of recurrence.

¹ Quoted by Shurley, "Dis. of Throat and Nose," p. 592.

² Delavan, "A Consideration of the Statistics of the Operation for the Relief of Malignant Disease of the Larynx," *New York Med. Journ.*, 1900, lxxii, p. 449. Abstract, *Journ. Laryngol., Rhinol., and Otol.*, 1900, xv, p. 649.

³ Chiari, "The Treatment of Cancer of the Larynx," "Trans. Amer. Laryngol. Assoc.," 1909, p. 19.

⁴ *New York Med. Journ.*, 1902, lxxxvi, p. 1020.

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Chiari¹ (Vienna), in 1909, made an exhaustive review of the general statistics of laryngo-fissure, and refers to 99 cases between 1895 and 1908. Of these 5 (5 per cent.) died from the operation, 19 (19 per cent.) from recurrence, 23 from insufficient operation (23·3 per cent.); whilst the cures amounted to 52·4 per cent., made up of 33·3 per cent. relative and 19·1 per cent. absolute cures. He also gives his own personal statistics of 41 cases of laryngo-fissure for intrinsic cancer of the larynx from 1894 to 1907. Death followed operation in 3 cases (7·32 per cent.), recurrence in 11 (27 per cent.); whilst he divided the "cures," amounting to 36·75 per cent., into relative 9·75 per cent., and definite 27 per cent. In 12 cases (29·2 per cent.), there had been too short an observation period to report upon.

Chevalier Jackson² (Pittsburgh), in reporting his results up to 1913, says that out of 27 cases, 24 were free from recurrence at the end of the first year, 3 died of recurrence, and he had no operative mortality.

StClair Thomson, between 1900 and 1917, has also achieved successes, which yield a permanent cure in 80 per cent. of cases. In his first series³ of 10 cases, between 1900 and 1910, he reports that only one patient died from local recurrence, and the death-rate from operation was nil. In the only two patients in which there was local recurrence the disease reappeared within the year following the operation.

He has performed⁴ thyro-fissure, up to February, 1919, on 38 patients for intrinsic cancer of the larynx. In 4 cases the patients were females and in 34 males. The ages of the patients varied from forty-four to seventy-five years.

Only one death occurred—in a very alcoholic subject, following an extensive subglottic recurrence and after a second thyro-fissure was performed. The death was

¹ "Trans. Amer. Laryngol., Rhinol., and Otol. Soc.," 1909, pp. 18 and 21.

² "Peroral Endoscopy and Laryngeal Surgery," 1915, p. 657.

³ "Trans. Med. Soc. Lond., 1912, xxxv, p. 200. *Brit. Med. Journ.*, 1912, i, p. 355. *Lancet*, 1912, i, p. 504.

⁴ "Trans. Med. Soc. Lond.," 1919, xlii, p. 105; *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, pp. 145-153.

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undoubtedly due to an idiosyncrasy for heroin which had been given after operation.

Twenty-eight cases were "relative cures"—i.e., no recurrence for one year (80 per cent.). Fourteen of these were well 3 years after the operation; one of them is well 10 years after operation. Some of the others, being elderly subjects, have died of other complaints.

In 6 cases there was recurrence of the growth within a year.

In all cases a tracheotomy was performed first, but in many instances the tube was removed at the end of the operation.

Summary of the Results of Thyro-fissure and Complete Laryngo-fissure.—A comparison of these statistics of different operators shows that the results have greatly improved during recent years. From 1851 to 1894 the percentage of cures was only 22 per cent. and recurrence in 20 per cent. of cases.

Between 1888 and 1894 the percentage of cures increased to 50 per cent., whilst recurrence remained at 20 per cent.

Since 1894 the percentage of cures varied from 52 per cent. to 80 per cent., whilst recurrence varied from 19.1 per cent. to 13.6 per cent. (Chiari). Since 1904 the death-rate from operation in experienced hands has been reduced to *nil*.

It would appear that the percentage of cures still varies with different operators from 25 to 80 per cent., owing probably to imperfect technique, or to operating on unsuitable cases, whilst Chiari¹ says that personal statistics show the results to be so exceedingly variable that the percentage of deaths varies from 0 to 25, recurrences from 0 to 92, and cures from 7.7 to 87.

These later statistics show the enormous progress in the hands of the skilled and experienced specialist over the results of 25 years ago. Nowhere in the whole of the realm of the surgery of malignant diseases, says Chevalier Jackson,² have such results been obtained. This success is due partly to the earlier diagnosis of the disease and partly to improvement in operative procedure.

While diagnosis and technique have improved, there

¹ "Trans. Amer. Laryngol., Rhinol. and Otol. Soc.," 1909, p. 22.

² "Peroral Endoscopy and Laryngeal Surgery," 1915, p. 650.

still remains room for a better instrumentarium. Just as in endoscopy the wise selection of instruments may be a great factor of success, so in this operation of thyro-fissure it is important that suitable instruments should be used if we are to attain the best results. The instruments¹ which I have designed for this operation have been for some years in use, though they have not yet been formally introduced to the profession, since it was my desire that they should first stand a fair trial. They are now used and recommended by StClair Thomson² and a number of my colleagues.

References to medical literature and reports of cases show that the work of Butlin and Semon in this country has been ably followed up by StClair Thomson, Herbert Tilley, Lambert Lack, Douglas Harmer, Dundas Grant, William Hill, Dan Mackenzie, Logan Turner, Brown Kelly, William Milligan, Richard Lake, De Santi, Cathcart, Barwell, Jobson Horne, and others in this country, and abroad by Solis-Cohen, Delavan, Chevalier Jackson, Clinton Wagner, Chiari, Koshier, Schmiegelow, Moure, and others.

The object of this monograph is to embody the practical experience acquired in performing or co-operating with my colleagues in over fifty laryngo-fissures in this country during the past twelve years, also to enumerate the various developments and improvements which have been found of service in increasing the successful results of this operation, and in reducing the death-rate.

*Indications for Laryngo-fissure.*³

1. Exploratory purposes.
2. Removal of foreign bodies in the larynx, when found impossible *per vias naturales*, by an experienced specialist.

¹ Shown at the Laryngological Section, Royal Society of Medicine. See "Proc. Roy. Soc. Med.," 1915, ix (Sect. Laryngol.), pp. 34-36; also Irwin Moore, "The Operation of Laryngo-fissure: Some New Instruments Specially Designed for Improving the Technique," *Lancet*, 1916, ii, p. 675.

² "Intrinsic Cancer of the Larynx after Operation by Laryngo-fissure," "Proc. Roy. Soc. Med.," 1915, ix (Laryngol. Section), p. 8.

³ Semon, "Indications for Thyrotomy," 13th Internat. Med. Cong. (Paris), Aug., 1900. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 504. Uruñuela (Madrid), "Indications for and Technique of Thyrotomy," 13th Internat. Med. Cong. (Paris), Aug., 1900. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 612.

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3. Injuries to the larynx—to avoid the troublesome results of serious lesions.

4. Laryngocele.

5. Stenosis of the larynx from congenital webs and from chronic inflammatory lesions.

6. Acute laryngeal perichondritis.

7. Laryngeal tuberculosis (including lupus).

8. Scleroma of the larynx.

9. New growths in the larynx.

(a) Benign (extirpation of large benign tumours in which intra-laryngeal treatment has failed).

(b) Malignant.

Indications for
laryngo-fissure
are rare.

It is with the operation of laryngo-fissure for intrinsic cancer of the larynx that this monograph specially deals.

Laryngo-fissure under Local Anæsthesia.—Laryngo-fissure can be performed under local anæsthesia, and it has been recommended, amongst others, by Bruns (Berlin), Kocher (Berne), and Edmund Meyer (Zurich). A number of cases have been reported in which the operation has been successfully carried out, but it is a severe ordeal, especially to sensitive patients, and a considerable strain to the operator. Cocaine cannot remove fear from a patient and the resulting shock to the nervous system.

StClair Thomson¹ has performed one operation under eudrenine infiltration anæsthesia and cocaine swabbing of the larynx. In exhibiting the case at the Royal Society of Medicine in 1903 he remarked that “the operation under local anæsthesia, *qua* the operation, was infinitely preferable to that under general anæsthetic, for it was easy to get the patient to cough, which was useful at certain times to prevent the blood and mucus from going the wrong way; but on the other hand, the mental and moral strain was much greater under local anæsthesia, both to surgeon and patient.”

During recent years, however, improvements in operative

¹ “Proc. Laryngol. Soc. Lond.,” 1903, ii, p. 68. “Proc. Roy. Soc. Med.,” 1910, iii (Clinical Sect.), p. 120.

posture, gauze tamponage of the trachea, and cocaine injections into the larynx and trachea have done away with the difficulties of dealing with blood and mucus under general anæsthesia ; hence any advantages of local anæsthesia over general anæsthesia need not at the present day be considered.

Certain Details in the Technique have an Important bearing on the Immediate and After-results of the Operation, and it is well to consider them under the following headings :

1. Preparation of the patient for operation.
 - (a) Preliminary hypodermic injection of narcotics.
 - (b) Intradermic injection of cocaine or its substitutes in the middle line of the neck.
2. Choice of general anæsthetic.
3. Posture of the patient during operation.
4. Cutaneous incision and dissection of pre-laryngo-tracheal region.
5. Puncture injection of cocaine into the trachea preliminary to tracheotomy, also into the larynx preliminary to fissure.
6. Temporary tracheotomy.
7. Division of the thyroid cartilage.
8. Swabbing of interior of the larynx with cocaine.
9. Tamponage of trachea above tracheotomy tube.
10. Examination of interior of larynx.

Inspection and palpation of the growth.
11. Subperichondrial resection of the growth.
 - (a) Separation of the perichondrium from the inner surface of the thyroid cartilage.
 - (b) Parallel horizontal incisions, first below and then above the growth, with scissors.
 - (c) Separation of the mass from the arytaenoid region.
12. Stoppage of bleeding.
13. Closure of the larynx and neck wound.
14. Removal of the tracheotomy tube.
15. Post-operative posture, and after-care of the patient.
16. Result of operation as regards recurrence and voice.

CHAPTER VI

PREPARATION OF THE PATIENT FOR OPERATION

THE rules of strict aseptic surgery should be carefully observed both before and during the operation. Although complete asepsis cannot be obtained, yet endeavours should be made to procure it as perfect as possible. The mouth should be carefully examined and all decayed teeth or stumps removed, whilst special attention should be given to the toilet of the mouth for at least forty-eight hours before operation, antiseptic washes being freely used. It is advisable to cut off all tobacco and alcohol for at least a week beforehand and it may be useful to give the patient a course of bromides.

The patient should be placed in a nursing home or hospital at least twenty-four to forty-eight hours before the time of operation and be prepared in the usual way for the anæsthetic. A purgative is best administered two nights before the operation, followed by a saline purge next morning, so as to avoid unnecessarily disturbing the patient on the morning of the operation. The importance of preliminary purgation in eliminating toxins from the alimentary canal and system prior to this operation has been repeatedly drawn attention to by different writers.

Preliminary Hypodermic Injection of Narcotics.—Preliminary narcotics not only encourage quiet induction of anæsthesia, which means less straining and congestion, but also diminish surgical shock, especially in the case of patients who are frightened or of a highly nervous temperament. By their calmative influence patients may be entirely freed from the fear and nervous tension which generally precedes an operation.

Crile (Cleveland, Ohio) says : “ We should obliterate the

emotion of fear and worry by morphia, which directly prevents shock."

Hewitt¹ advised that "for excitable, apprehensive patients the use of appropriate preliminary narcotics was almost essential to success."

Hugh R. Phillips² considers that the preliminary injection of narcotics is, in most cases, invaluable and should be given in all cases where there is no idiosyncrasy, and he thinks it is worth while to give the patient a trial dose a few days before the operation to make quite sure on this point. He recommends that morphine sulphate, gr. $\frac{1}{6}$, and atropine sulphate, gr. $\frac{1}{100}$, should be given three-quarters of an hour before the patient is brought into the theatre, as this not only allays the natural feeling of apprehension, but helps to prevent secretion and lessens the amount of general anæsthetic necessary. There is less tendency to cough or retch during the operation, and the annoyance caused by bleeding is minimised. A further advantage, he says, is that if there are signs of shock, ether can be administered without giving rise to laryngeal spasm. If the patient is either specially nervous or of the alcoholic type, the addition of hyoscine hydrobromide, gr. $\frac{1}{100}$, is advantageous, or omnopon-scopolamine, 1 c.c., may be substituted for the morphine and atropine.

Bellamy Gardner³ does not find that patients who require this operation are especially nervous beforehand, but are looking forward to the relief of their symptoms. In view of this, he says narcotics are not called for as a preliminary routine from the psychological point of view, and as they reduce the vitality of the respiratory centre, which may be required at its maximum activity at certain moments before the tracheotomy has been completed, and cause somnolence and absence of coughing reflex during recovery, they are best avoided altogether.

Narcotics are undoubtedly valuable in plethoric, alco-

¹ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Anæsth.), p. 19.

² Personal communication to author.

³ Personal communication to author.

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holic, or muscular subjects, and it is said that one advantage in their use is that less anæsthetic is necessary, and, consequently, a lighter and safer degree of narcosis may be maintained throughout the operation. Chloroform lowers blood-pressure and conduces to shock. Atropine, administered before chloroform anæsthesia, checks excessive inhibition of the heart and controls and diminishes mucous secretions. Morphia, therefore, in the form of morphia sulphate, gr. $\frac{1}{8}$, in combination with atropine sulphate, gr. $\frac{1}{160}$, is frequently given as a hypodermic injection half an hour before general anæsthesia.

Levy¹ has recently expressed the opinion that "atropine may foster cardiac syncope under chloroform."

Since morphia and cocaine are antidotes to each other, the injection of morphia acts as a prophylactic in preventing the risk of cocaine poisoning, consequently cocaine may be used during the operation for controlling the laryngeal reflexes with far greater freedom and in larger quantities.

Some patients, however, are most susceptible to narcotics, therefore if they are used in any form, great care and discretion should be exercised in each individual case, especially when prescribing heroin, for it has been found that patients have been profoundly narcotised by $\frac{1}{12}$ gr. It is a well-established rule that narcotics should not be given to patients suffering from any respiratory difficulties, therefore the importance of avoiding respiratory depressants cannot be disputed in cases of malignant disease of the larynx, in which the glottis is narrowed, owing to partial or complete fixation of the vocal cord.

Regional Method of Infiltration by Cocaine or its Substitutes.—The initial incision and dissection for both tracheotomy and laryngo-fissure may be rendered practically bloodless by the intradermic injection of the line of incision in the neck with cocaine or its substitutes twenty minutes before operation. As the result of careful preliminary preparation, many recent operations have been performed without even using artery forceps or tying a vessel.

¹ "Proc. Roy. Soc. Med.," 1917, xi (Sect. Anæsth.), p. 12.

The intradermic infiltration method of local anæsthesia with cocaine was first introduced by Reclus¹ in 1889, and he recommended that a weak solution of from 1 to 2 per cent. should be used, insensibility being obtained over an area of about half an inch from the punctures.

Cocaine, by itself, may be used in 5 per cent. solution for hypodermic injection, and should be freshly prepared for each operation to avoid the formation of a fungus which may appear in a few hours, when it becomes septic. Again, it becomes acid on standing, and loses greatly in anæsthetic value. One grain of cocaine is a safe dose for absorption in an adult (Chevalier Jackson).

Novocain is less toxic than cocaine, and may be used in a 2 per cent. solution with a few drops of adrenalin.

Eudrenine, a mixture of eucaine and adrenalin, is by far the best preparation. It is put up in ampoules of 0.5 c.c., containing $\frac{1}{12}$ gr. of betaucaine hydrochloride (1 per cent.), with $\frac{1}{4000}$ gr. of adrenalin chloride (1 in 30,000) in physiological sodium chloride solution preserved with chloretone. It is to be preferred to cocaine because its toxicity is less and the contents of three or four of these ampoules may be injected without any risk. In all infiltration work it is important to remember that to anæsthetise the skin the injection should be intradermic—*i.e.*, between the layers of the skin—not hypodermic—*i.e.*, beneath it—since the sensory nerve endings are situated just beneath the epithelium. The position of the needle is correct if its point can be seen from the surface. Pain of the initial prick of the needle may be done away with or reduced by applying to the skin a drop of pure carbolic acid on the point of a probe (Fig. 1). One or two deep injections may be given into the tissues, but this is not necessary since the subdermal tissues are not sensitive.

The author generally uses a long needle 3 in. in length, which is inserted through the skin at the suprasternal notch, the site of puncture having first been anæsthetised by a drop of pure carbolic. The needle is pushed upwards intra-

¹ Paul. Reclus et Isch Wall, *Revue de Chirurgie*, ix, p. 149, 1889.

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dermically along the middle line of the neck as far as the upper border of the thyroid cartilage, whilst the skin is drawn or threaded downwards on to the needle as it advances by the thumb and forefinger of the left hand. This causes little or no pain. The needle is gradually withdrawn whilst the solution is squeezed out of the syringe (Fig. 1). In some



FIG. 1.—Local infiltration anaesthesia of the middle line of the neck showing position where the hypodermic needle should be inserted through the skin.

cases where the patient has difficulty in extending the neck through stridor, it may be advisable to use a shorter needle and divide the injection line into two parts, the needle being first inserted at the suprasternal notch and passed up as far as the thyroid isthmus, while it may again be re-inserted at the level of the hyoid bone to meet the upper limit of the first injection.

General Anæsthesia and its Methods of Induction.—General anæsthesia is always indicated since it avoids pain and shock. Special experience and training are required.

Bellamy Gardner,¹ who has had a large experience in the anæsthetising of laryngeal cases, expresses his opinion as follows: "Chloroform is the only suitable anæsthetic for these cases. It may be quite well administered during induction upon a Skinner's mask until the tracheotomy has been effected, and then continued by means of a Junker's bottle with a long, flexible, leaden tube fitted to its distal efferent end, which should be small enough to rest within the orifice of the tracheotomy tube without obstructing the expiratory tidal airway. I think it necessary to point out very distinctly that an *orthopnœic* patient—that is, one who is unable to lie down owing to dyspnœa—is in danger of complete obstruction under chloroform if laid down flat at any moment until the trachea has been opened. This should be obvious, but is frequently forgotten, as if the orthopnœa were a fancy on the part of the patient and not the dire necessity which it undoubtedly is. A small mouth-prop should be inserted between the teeth before the induction of anæsthesia, and a tongue-clip should be at hand in case laryngeal obstruction supervenes. Gauze tampons around and above the tracheotomy tube form a more secure plug than the sponge packing of Hahn's tube. I think it far better to leave the tracheotomy tube *in situ* for twenty-four hours after the operation, as I have known one patient drowned by after-hæmorrhage in the night whose tube had been removed at once. There is no objection to inducing anæsthesia in the propped-up position; but great care must be observed in lowering these patients and especially in extending the neck backwards, which is apt to tighten the vocal cords and produce complete respiratory obstruction. There should certainly be no undue delay in opening the trachea, though I have known it take the best part of an hour when all the latest ritual practices had been observed."

¹ Personal communication to author.

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The warmed vapour of chloroform and oxygen is recommended by some anæsthetists, and is best administered by means of a special apparatus as used by Hugh R. Phillips¹ or by the very useful apparatus designed by Shipway.²

Chevalier Jackson advocates the use of intratracheal insufflation of ether on the grounds that it dispenses with a tracheotomy tube, allows a shorter incision—thereby saving time—and regulates better the anæsthetic, so that the cough reflex can be stimulated or controlled at the will of the anæsthetist during the operation.

The serious objections, however, to a short incision, the operative risk of performing laryngo-fissure without a preliminary tracheotomy, and the safer method of controlling and regulating the cough reflex by means of local injections and applications of cocaine will be dealt with later. Ether, alone or in combination, by irritating the mucous membrane, greatly increases the tracheal and bronchial secretions and should be avoided.

¹ "Apparatus for Administering Oxygen with Ether and Chloroform,"

"Proc. Roy. Soc. Med.," 1917, xi (Sect. Anæsth.), p. 13.

² "Administration of Warm Anæsthetic Vapours," *Lancet*, 1916, i, p. 70.

CHAPTER VII

POSTURE OF THE PATIENT DURING OPERATION

THE most satisfactory position is one which not only prevents the entrance of blood into the trachea and bronchi, but also any mucus or other secretions from the pharynx entering the larynx (Figs. 19 and 22). It should, at the same time, be a position which causes least congestion of the vessels of the head and neck.

In the Trendelenburg position, which is used by some operators, the operating-table is tilted in such a way that the patient lies at an angle of 35 or 45 degrees with the pelvis and lower part of the abdomen raised, whilst the head and shoulders are lower than the level of the body to the extent that all fluids gravitate from the larynx and trachea. In the Rose or hanging-head position the patient's shoulders, after induction of anæsthesia, are drawn to the end of the table and elevated by a firm cushion, whilst the head is allowed to hang over the end of the table, firmly grasped on each side by an assistant's hands in order to steady and keep it in the middle line (Figs. 15 and 16). This position is commonly used for performing a low tracheotomy, especially in patients who have a short, fat neck. Chevalier Jackson uses the Trendelenburg-Rose position, which is a combination of these two positions. The advantage of these positions is that there is little danger of an aspiration pneumonia following the operation.

The objection, however, to these two positions is that the veins of the head and neck become distended with blood owing to gravitation, and considerable oozing of blood may

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consequently occur in the operation field, thus impeding the view of the parts. The difficulties of hæmorrhage occurring during removal of the growth has frequently been referred to by writers, though Butlin¹ says he had never seen bleeding which could cause the least anxiety. The position recommended by the author is one in which the patient is placed on the back on the operating-table, whilst the shoulders are elevated by a firm cushion; this brings the head into full extension. A second cushion or sand-bag is then placed under the neck in order to raise it and cause the structures on its anterior aspect to become stretched and prominent (Fig. 19).

This is the ideal position and the one advised for thyro-fissure, since it is more comfortable for the operator to work in this position and less dangerous for the patient.

Chevalier Jackson has pointed out that while blood can be aspirated up the inclined closed trachea, it is impossible for it to be aspirated along an open trough—*e.g.*, the opened larynx; so that with the head, neck, and shoulders in this position it is apparent that there is little risk of any blood entering the trachea and lungs after the thyroid cartilage has once been opened (Fig. 22).

¹ "The Operative Surgery of Malignant Diseases," 1900, p. 191.

CHAPTER VIII

INCISION AND DISSECTION OF THE PRE-LARYNGO-TRACHEAL REGION

IN the preliminary dissection of the neck the following important points should be kept in mind :

1. Operate slowly and divide the structures carefully layer by layer.

2. Make a free, external incision, because it gives more room and facilitates the subsequent stages of the operation.

3. Use the knife as little as possible after the first incision through the skin.

Thyro-fissure, so well described by Clinton Wagner,¹ is not an operation for the display of brilliancy and dash ; it is a tedious operation, in which, in order to secure safety, celerity should not be attempted.

If the patient is placed in the Rose or hanging-head position, an assistant should be specially instructed to keep the head steady and see that the chin, thyroid notch, and sternum are in the same straight line (Fig. 2). For this purpose he should be seated on a stool above the patient's head, with his hands placed on either side of the head (Figs. 15 and 16) ; but if the position recommended by the author is employed (Fig. 19), an assistant at the head is unnecessary.

Standing on the right side of the patient, the operator makes a free incision exactly in the middle line of the neck from the lower border of the hyoid bone to the sternal notch dividing the skin and superficial cervical fascia (Fig. 2). In the tracheal region the two ends of the incision should

¹ *New York Med. Record*, 1896, xlix, p. 1.

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be gradually bevelled in from the external surface at each end, the longest part of the cut being the external one. For this purpose a large-bellied knife is better than the ordinary sharp-pointed bistoury. It will be found that the

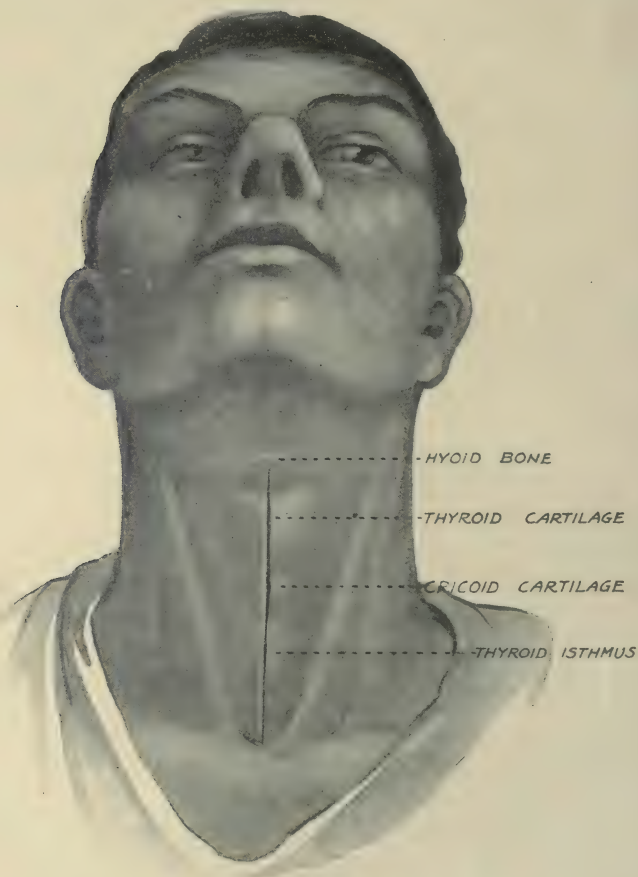


FIG. 2.—Anterior surface of the neck showing landmarks, also the position of the skin incision for the preliminary tracheotomy, and thyro- or laryngo-fissure operations.

superficial fascia in this situation is more of a loose, areolar tissue containing a little fat than a distinct layer. This incision exposes the superficial layer of the deep, cervical fascia, through which the anterior jugular veins may be seen passing down one on each side of the middle line, with a

communicating branch crossing the middle line just above the sternal notch (Fig. 3). The dissection should now proceed more carefully, and the incision be still kept exactly in the middle line so as to avoid wounding these veins. On dividing the superficial layer of deep fascia with a few touches of the point of the knife, the jugular veins attached to the loose,

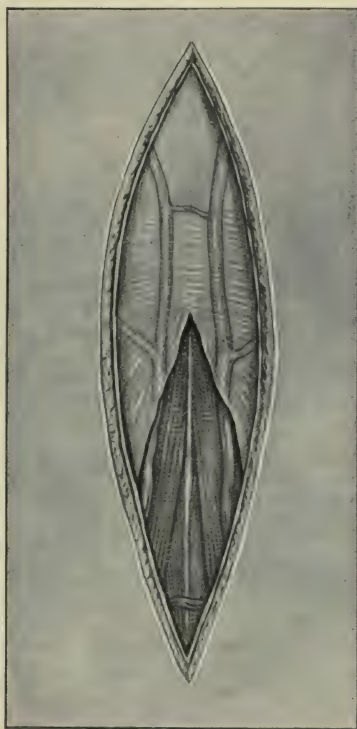


FIG. 3.—*The Laryngo-tracheal region.*—The superficial fascia has been incised. The superficial layer of the deep fascia is seen in the upper half of the dissection with the anterior jugular veins embedded in it, one on each side of the middle line, whilst the communicating branches are seen crossing the middle line. The superficial layer of the deep fascia has been incised in the lower half of the dissection, exposing the sternohyoid and sternothyroid muscles. The white line of fascia between these muscles is well seen.

areolar tissue may be drawn aside. If, however, they or their communicating branches are in the way, they may be seized, divided between two compression forceps, and, later, ligatured. A single vein may exist in the middle line

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or to one side of it; this may also be avoided by careful dissection. The sterno-thyroid and sterno-hyoid muscles are now reached and may be recognised by the white line of firm fascia which separates them (Fig. 3). It is important to find this median interval, and the muscular fibres should not be cut or torn, for considerable bleeding may occur.

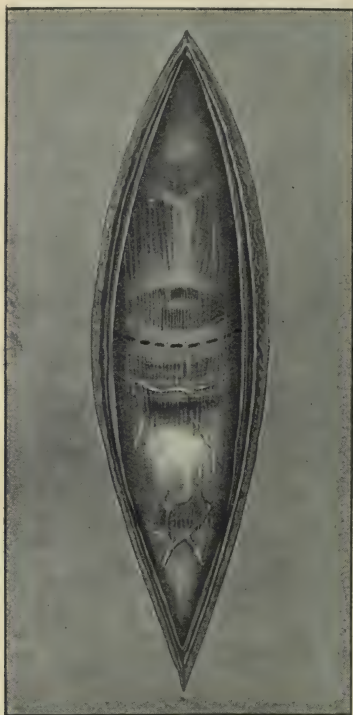


FIG. 4.—The sterno-hyoid and sterno-thyroid muscles have been separated so as to expose the deep fascia covering the thyroid and cricoid cartilages, the thyroid isthmus, and the trachea. The communicating branches of the superior and inferior thyroid veins are seen running in the fascia across the middle line. The dotted line across the cricoid cartilage indicates the position for incising the deep fascia in separating the thyroid isthmus from the trachea. Lying on the crico-thyroid membrane in the middle line is seen the pre-laryngeal gland.

With a few touches of the point of the knife the incision is carried along this line, the muscles being separated by the handle of the knife or dissector and widely retracted. A knife with a thin, flat handle is useful as a dissector for tearing through the connective tissue. This brings into view the

deep fascia covering the underlying thyroid cartilage, crico-thyroid membrane, isthmus of the thyroid, and trachea (Fig. 4). This fascia divides at the upper border of the isthmus into two portions—one extending in front and the other behind it—whilst they unite at the lower border to pass downwards over the trachea. At this stage the rings of

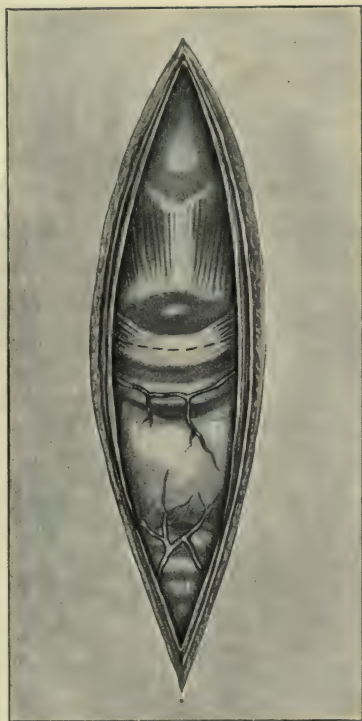


FIG. 5.—This drawing shows the deep fascia removed. The communicating branches of the superior and inferior thyroid veins are well seen running across the middle line.

the trachea may be felt with the finger. There are generally seven or eight rings between the cricoid cartilage and the top of the sternum. The isthmus of the thyroid is seen crossing the second and third rings of the trachea. Occasionally, if the isthmus is wide, it may extend as far as the cricoid cartilage, and as far down as the third or fourth rings. Lying on the crico-thyroid membrane in the middle line will be

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seen a gland (Figs. 4 and 5)—the pre-laryngeal gland¹—in the space between the crico-thyroid muscles. In some cases there are two glands (1 in 6). The lymphatic vessels which proceed from the subglottic region of the larynx pass through the crico-thyroid membrane to this subcutaneous gland, or, when absent, the lymphatic trunk vessels pass direct without any anastomosis into neighbouring lymphatic systems and into inferior lateral glands between the larynx and carotid (Cunéo).² This pre-laryngeal gland, when present, is the first one involved in the extension of intrinsic cancers of the larynx, and, if enlarged, may be the size of a large haricot bean. Its enlargement is seldom felt on palpation, but it may be revealed after making the skin incision in the operation of laryngo-fissure, and indicates that the disease has spread from the inside to the outside of the larynx and has passed the stage for successful extirpation by laryngo-fissure.

To this peculiar lymphatic arrangement is due the success of thyro-fissure in early cases, since the cancerous process does not for a long time reach the cartilage (Chevalier Jackson).³

¹ Poirer, *Ann. des Mal. de l'Oreille, du Larynx, etc.*, May, 1887. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1887, i, p. 309.

² P. Poirer and B. Cunéo (Paris), "The Lymphatics," English edit., by Cecil H. Leaf, 1903.

³ "Peroral Endoscopy and Laryngeal Surgery," 1915, p. 651.

CHAPTER IX

TEMPORARY TRACHEOTOMY

TRACHEOTOMY is a simple operation which should always be performed before opening the larynx. Some surgeons—amongst others Chevalier Jackson, Moure (Bordeaux)—open the larynx directly without a previous tracheotomy, the anæsthetic being maintained through the open larynx or by means of an inhalation insufflation tube passed through the mouth. Experience, however, has proved the necessity and great advantages of a preliminary tracheotomy, for by this means, along with tamponage of the trachea above the cannula, blood and septic matter are prevented from passing into and obstructing the air-passages, so that the risk of septic bronchitis and pneumonia is avoided; also free and proper respiration is assured, together with the safe and continuous administration of the anæsthetic.

The question of whether a median or low tracheotomy should be performed may now be considered.

(a) *The Median Operation.*—It is intermediate between the high and low operation, the incision in the trachea being made through the third and fourth rings (Figs. 9 and 13). Since these rings are situated behind the thyroid isthmus it is generally necessary, in order to expose them, to separate the isthmus from the trachea and divide it in the middle line. The deep layer of cervical fascia connecting the isthmus to the cricoid cartilage is first divided from the cricoid downwards, or a transverse incision may be made along the lower border of the cricoid (Figs. 4 and 5). A periosteal elevator is then inserted under

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the fascia, which is stripped downwards, whilst the instrument is passed under the isthmus, raising and separating it from its attachment to the trachea (Fig. 6). In some cases these rings may be exposed by merely reflecting the isthmus downwards without dividing it. In the space between the

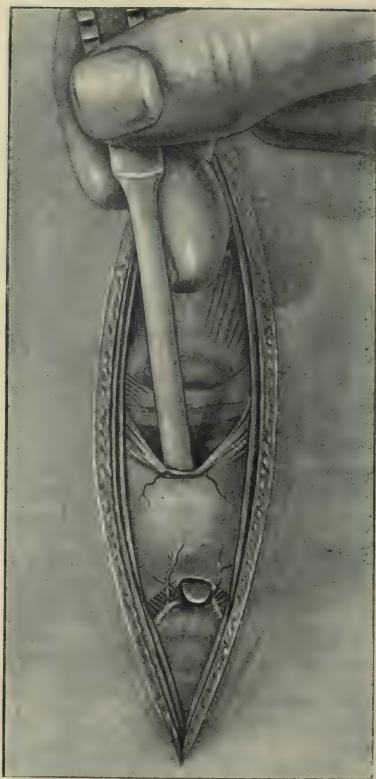


FIG. 6.—Separation of the thyroid isthmus from the trachea by first incising the deep fascia attached to the cricoid cartilage and then undermining it with an elevator. Shows the superior thyroid veins drawn down with the reflected fascia.

cricoid cartilage and the isthmus there is generally no vessel met with, but there may be a communicating branch between the two superior thyroid veins, which may require dividing and ligaturing; this, however, is generally contained in the deep fascia covering the crico-thyroid membrane, and is reflected along with the fascia during the separation of the isthmus.

The advantages of the median operation are that the trachea is not so deep as in the low operation, whilst there is ample room above the tracheotomy tube to allow for the operation on the larynx.

Again, in this situation the trachea is more superficial than below the thyroid isthmus—the position for low tracheotomy—hence a tracheotomy tube can be more easily and quickly re-inserted if the necessity arises.

Wilfred Trotter,¹ in discussion, confirms the advantages of median tracheotomy over high or low tracheotomy and points out that the isthmus, which has been retracted downwards or upwards to expose the tracheal rings in a high or low operation, returns to its normal position when the tracheotomy tube is removed, and may interfere with the re-introduction of the tube by covering the tracheal incision. He has known patients' lives lost through this cause.

Thyroid Gland Clamp Forceps (Fig. 7).—These forceps are of use in clamping each side of the thyroid isthmus before division and ligaturing. It is advisable to ligature the isthmus on each side after division, even though its vascularity may be only slight, so as to avoid not merely the chance of secondary hæmorrhage, but also the risk of acute thyroidism, which, it is said, has occasionally occurred as a sequel and depends upon the unregulated, excessive absorption of thyroid secretion into the system. The symptoms are mainly those of rapidity of the pulse and extreme restlessness, and may appear within a few hours of operation.

Wilfred Trotter² says he has never seen any of the symptoms which were supposed to follow division of the thyroid isthmus and escape of thyroid juice into the system. He regards this source of thyroid exacerbation as fallacious.

The clamps (Fig. 7) are made on the principle of the Spencer Wells angular forceps, but have the outer surfaces of the blades flattened to facilitate their introduction between the thyroid isthmus and the trachea, whilst the inner surfaces

¹ Discussion on StClair Thomson's paper, "Intrinsic Cancer of the Larynx," "Trans. Med. Soc. Lond.," 1919, xlii, p. 118.

² "Trans. Med. Soc. Lond.," 1919, xlii, p. 118.

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are very finely serrated (Fig. 7). The blades measure $1\frac{1}{2}$ in. in length. If the isthmus is broad, each half may be separ-



FIG. 7.—Thyroid gland clamp forceps. $\frac{3}{8}$ scale.

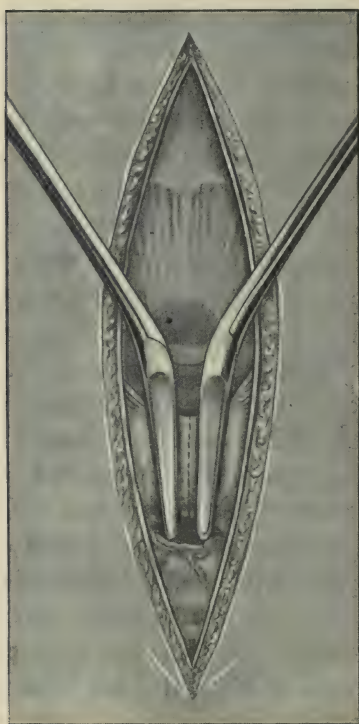


FIG. 8.—Thyroid gland clamps in position before division of the isthmus—one on each side of the middle line. The dotted line shows where the thyroid isthmus should be divided.

ately clamped and ligatured in two portions, and for this purpose four of these clamps may be required.

Fig. 9 shows the clamp forceps attached to the two halves of the thyroid isthmus after separation in the middle line,

together with the correct position of the incision in the trachea—*i.e.*, through the third and fourth rings—for the introduction of the tube in the median operation of tracheotomy.

(b) *The Low Operation.*—In some cases where the neck is short and stout the distance between the thyroid cartilage

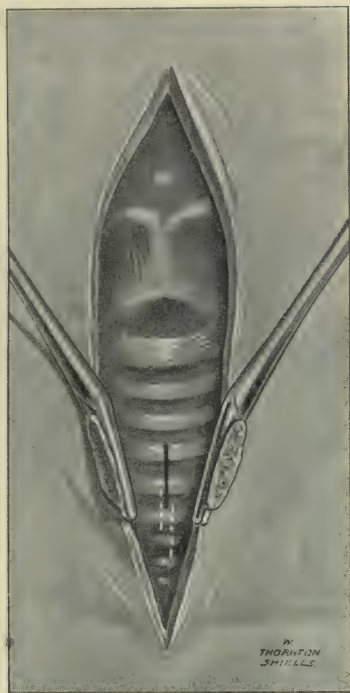


FIG. 9.—The thyroid isthmus divided and clamps attached. The black line indicates the position of the incision in the trachea for median tracheotomy. The white dotted lines (which it has been necessary in the drawing to place a little to each side of the middle line) represent the alternative incisions in the trachea for a low tracheotomy, *i.e.*, through the fourth and fifth or fifth and sixth rings.

and the sternum is considerably decreased, and it may be necessary to perform a low tracheotomy—*i.e.*, below the thyroid isthmus—between the fourth and fifth or fifth and sixth rings of the trachea. The disadvantage of a low operation is that the trachea in this situation lies deep, and is covered by the deep cervical fascia and fat and a quantity of areolar

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tissue in which the inferior thyroid plexus of veins runs ; but if a slow and careful dissection is carried out by dissecting forceps, the fascia divided longitudinally or separated by tearing apart with the forceps, the veins drawn aside or downwards along with the fascia, and the lower border of the

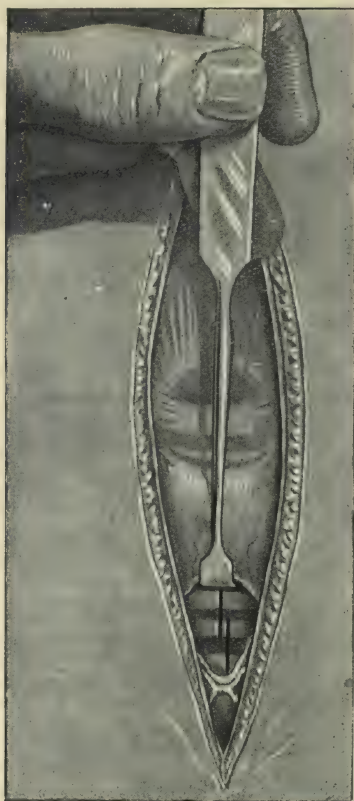


FIG. 10.—*Low Tracheotomy*.—Shows the deep cervical fascia separated below the thyroid isthmus, the lower border of which is raised up by means of a retractor, thus exposing the fourth and fifth rings of the trachea. It will be seen that the inferior thyroid plexus of veins is drawn downwards out of the way along with the deep fascia. The black line indicates the alternative positions of the tracheal incision in a low tracheotomy, *i.e.*, through the fourth and fifth or fifth and sixth rings.

isthmus drawn upwards from the trachea by a retractor (Fig. 10), the exposure of the trachea in this region is almost as easy as a median tracheotomy.

The inferior thyroid veins are usually found a little to

each side of the median line, and may be displaced to the sides. Occasionally there are two veins on the left and one on the right, and they are united by anastomosing branches of considerable size, which cross the trachea and are occasionally cut in a low tracheotomy. Should one of the trunks be divided the hæmorrhage may be severe on account of its close proximity to the innominate vein.

It should not be forgotten that in the over-extended position of the head and neck the trachea is drawn up out of the thorax and with it the great vessels. The left innominate vein which crosses the trachea below the top of the sternum may therefore be in danger of being cut, whilst the innominate artery which lies alongside the trachea below the vein and crosses the trachea as high as the sterno-clavicular joint may in exceptional cases reach higher (Fig. 22). The right common carotid artery sometimes crosses the trachea as high as the seventh ring. The thyroidea ima artery is occasionally found passing up the front of the trachea from the aorta to the thyroid body and must be avoided.

Solis-Cohen¹ performs a tracheotomy first and afterwards incises the skin only so far as to uncover the larynx, thus leaving intact a bridge of skin between the thyro-fissure and tracheotomy incisions, the idea being to reduce the dimension of the external wound. Later, if more room is required, the bridge is cut through. There is nothing, however, to be gained by this procedure, for experience has shown that a free incision, by giving more room, contributes in no small way to the success of the thyro-fissure operation, and it certainly reduces the difficulties and dangers met with during a deep dissection in the trachea when performing a low tracheotomy.

Before finally opening the trachea, it is important that the operator should see that all cellular tissue covering the rings which are to be incised has been removed, and that all hæmorrhage has been stopped, and any vessels already clamped have been tied, since the leakage of blood into the trachea may become a dangerous feature.

¹ *Laryngoscope*, 1907, xvii, p. 366.

CHAPTER X

COCAINISATION OF THE LARYNX AND TRACHEA

ONE of the most important points, if not the most important point, in the technique of this operation is the free use of cocaine as a local anæsthetic and hæmostatic agent. By its application to the interior of the larynx and trachea, all sensibility of the mucous membrane, reflex cough, and capillary hæmorrhage may be controlled.

Cocaine, which was isolated by Niemann (Gottingen) in 1860, was first introduced into surgery by Koller (Vienna) in 1884 as a local anæsthetic—painted on mucous membrane—for minor operations.

To R. W. Parker¹ belongs the credit of first realising its importance and suggesting the use of cocaine in 1886, *i.e.*, thirty-one years ago, for this operation, when he advised that after splitting the larynx the mucous membrane should be painted with a solution of cocaine “to diminish the capillary bleeding, reflex irritation, and coughing, which is invariably met with on first opening the larynx.” He referred to “the difficulty of seizing the growth owing to reflex excitability which the approach of any instrument set up, notwithstanding deep narcosis,” and says the use of cocaine in such cases materially aids the surgeon.

Jacobson,² in 1897, emphasised the great practical value of cocaine in these cases, and mentions that he got the idea from R. W. Parker.

Crosby Greene³ (New York), in 1913, further improved

¹ Heath's "Dict. of Practical Surgery," 1886, ii, p. 623.

² "The Operations of Surgery," 1897, 3rd edit., p. 383.

³ "Trans. Amer. Laryngol. Assoc.," 1913, p. 165. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1913, xxviii, p. 662.

the technique when he advised that a 1 per cent. solution of cocaine should be injected (as previously mentioned) through the crico-thyroid membrane into the cavity of the larynx, before it is opened, in order "to forestall reflex irritability of these parts" (Fig. 11). This important suggestion was first utilised in this country by StClair Thomson.

Crile¹ (Cleveland, Ohio) has confirmed the great advantages of cocaine in the surgery of the upper air passages, and has shown that the nerves in the region of the larynx and pharynx, especially around the glottis and the terminals of the recurrent laryngeal nerve, are endowed with strong inhibitory functions. Rough manipulations of these regions during operations may induce alarming and even fatal collapse due to a sudden reflex inhibition of the heart and respiration through irritation of the superior laryngeal branch of the pneumogastric nerve. In connection with the surgery of the larynx cardiac and respiratory inhibition is impossible if the area be well cocaineised. By its use, either by direct application to the mucous membrane or by infiltration of the nerve (which may be reached from the tip of the posterior cornu of the hyoid bone), operative shock is minimised or done away with, and a growth may be removed with perfect tranquillity.

Chevalier Jackson² advises a solution of 1 gr. cocaine hydrochloride and one drop of carbolic acid to 1 oz. of sterilised water, allowing the solution to stand long enough for chemical sterilisation to take place. To boil a cocaine solution, he points out, destroys its anæsthetic power.

An excellent way of preserving a solution of cocaine is to add to each fluid ounce of sterilised distilled water 2 gr. of phenol and 10 gr. of boric acid.

Gluck³ (Berlin) advises a solution of cocaine and antipyrin (5 per cent.) and carbolic acid (1 per cent.) in distilled water.

Prior to the use of cocaine the difficulties of the operation

¹ *Journ. Amer. Med. Assoc.*, 1900, xxxiv, p. 778. Also quoted by Bodine, *Laryngoscope*, 1903, xiii, p. 261.

² *Laryngoscope*, 1909, xix, p. 290.

³ *Ibid.*, 1903, xiii, p. 928.

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have been well described by Clinton Wagner¹ as follows :
“The introduction of the knife, together with the flow of blood, produces violent reflex action. The larynx rises and falls spasmodically and very rapidly, and the use of a knife or scissors is fraught with danger. The operator has need at this moment of all his coolness and presence of mind.

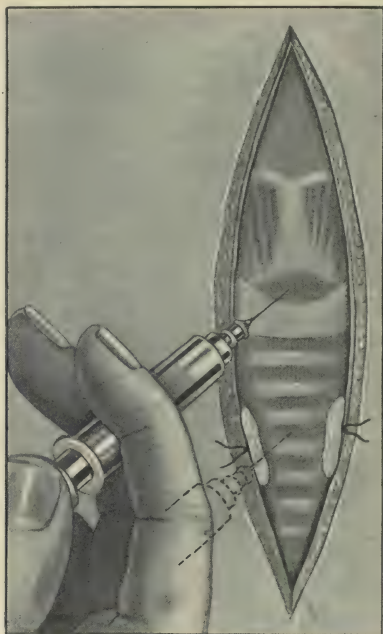


FIG. 11.—The two halves of the thyroid isthmus have been divided, ligatured, and the clamps removed. Shows positions where the hypodermic needle should be inserted, for cocainisation of the larynx and trachea.

Blood will find its way into the trachea and lungs, and death on the table from asphyxia may suddenly take place.”

This shows how greatly the technique has been simplified by the introduction of cocaine.

The larynx is less susceptible to the action of cocaine than the pharynx or the nose, and anæsthesia is less easily produced. It is now customary to inject 10 minims of a 2 per cent. solution of cocaine into the trachea (Fig. 11) to

¹ *New York Med. Record*, 1896, xlix, p. 1.

abolish the very marked spasm which invariably occurs on opening the trachea and to avoid the coughing of mucus over the vicinity. If a short interval be allowed to elapse after the injection, a tracheotomy tube may be inserted without any reaction whatever. During the interval the operator can return to the thyroid cartilage and prepare it for splitting by separating all overlying tissue and cutting through the perichondrium covering it in the middle line. A second injection of cocaine should now be given through the crico-thyroid membrane into the interior of the larynx before it is opened (Fig. 11) to allay the reflex irritability of these parts, as suggested by Crosby Greene (previously referred to).

Chevalier Jackson¹ also recommends that 2 c.c. of a 2 per cent. solution of cocaine should be used, injected into the larynx "to forestall excessive coughing."

A notch may be made with the knife in the cartilage across the middle line so as to indicate the accurate apposition of its two halves after the operation is completed. Formerly it was the custom to dissect the perichondrium and all overlying tissue back from the middle line for about one inch on each side, thus leaving the bare cartilage exposed; but this should not be done, for it encourages perichondritis and necrosis of the cartilage.

The operator now returns to the trachea and performs tracheotomy by inserting the knife in the interval between the fourth and fifth rings and making a free incision upwards through these rings. With a pair of rat-toothed dissecting forceps the nearer edge of the tracheal incision is seized, and the tube inserted into the trachea by depressing the opposite side of the incision. The tube may then be secured by tapes round the neck.

As a result of the tracheal injection of cocaine and the short interval allowed to elapse, it is found that the tracheotomy tube may be inserted without any reaction whatever, the reflexes remaining perfectly tranquil. The respiration is so quiet after insertion of the tube that one might almost conclude that the patient had stopped breathing.

¹ "Peroral Endoscopy and Laryngeal Surgery," 1915, p. 663.

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A tranquil anæsthesia may also be produced by skilled anæsthetists¹ with a general anæsthetic by inducing a more profound anæsthesia during and just prior to opening the trachea. Immediately after the tracheotomy tube is introduced the return to a light anæsthesia is obtained by the administration of oxygen.

Tracheal Shears (Fig. 12).—These are short, sharp-pointed scissors of the turbinotome type. They are useful for

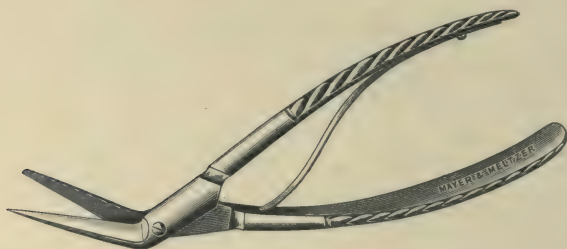


FIG. 12.—Tracheal shears. $\frac{1}{2}$ scale.

tracheotomy in cases where the tracheal rings are ossified, after middle life, and difficulty is experienced in cutting them with a knife. They are also useful for splitting the cricoid cartilage and opening the lower quarter of the larynx in those cases where more room is required, or for removal of a portion of the thyroid ala when it is implicated by the growth. The point of the lower blade being sharp, they can also be used for “stabbing” the trachea if necessary in place of a knife, when the occasion arises for an urgent tracheotomy.

¹ See F. S. Rood, “Anæsthesia in Throat and Nose Operations,” “Proc. Roy. Soc. Med.,” 1920, xiii (Sect. Anæsth.), pp. 1–10.

CHAPTER XI

DIVISION OF THE THYROID CARTILAGE

AN incision having been made through the perichondrium covering the thyroid cartilage exactly in the middle line from its upper to its lower border (Fig. 13), the thyroid cartilage is next divided from below upwards by means of a strong pair of shears (Fig. 14) specially designed for this purpose, and if care is taken over this, one vocal cord will lie in each lateral half of the larynx. In the case of growths that are close to the anterior commissure it is important that the division should be made a little to one side (Fig. 19) so as to avoid cutting through the malignant growth. Cutting through a growth is always contra-indicated, because of the risk of cancerous wound infection (Chevalier Jackson).

The question of splitting the thyroid cartilage from below is important, says Butlin,¹ "for the inner blade of the instrument working from above downwards may slit or detach one of the vocal cords at its anterior extremity, which, if the growth proves innocent and does not call for removal of any part of the vocal cords, almost certainly results in permanent injury to the voice."

Thyroid Cartilage Shears (Fig. 14).—These are used for splitting the thyroid cartilage at the angle where the two alæ meet in the middle line so as to expose the interior of the upper three-quarters of the larynx, and are also useful in splitting the cricoid cartilage in those cases where there is difficulty in reaching the subglottic extension of the growth and where additional room is required. They are very

¹ "The Operative Surg. of Malig. Dis.," 1900, 2nd edit., p. 199.

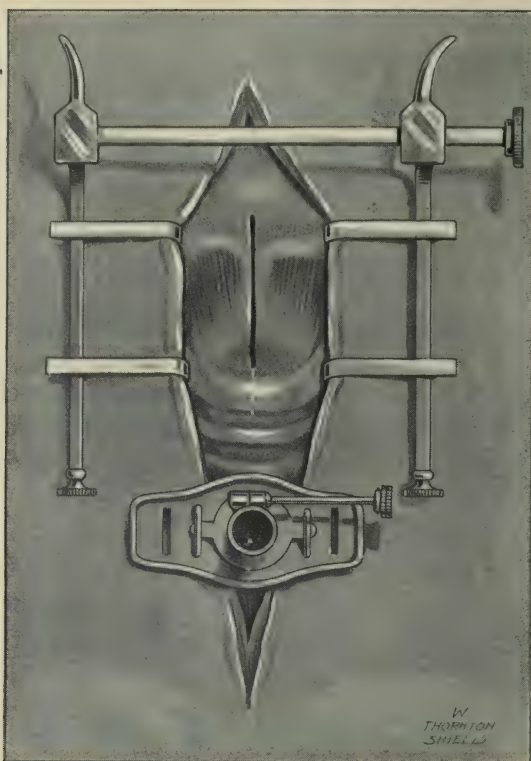


FIG. 13.—The skin and soft parts are seen held aside by a self-retaining retractor (Fig. 23) described later. Shows the correct position of a Durham's tube in the operation of median tracheotomy. The black line represents the incision made by the shears (Fig. 14) in splitting the thyroid cartilage in the operation of thyro-fissure, whilst the continuation of the incision (shown by the white dotted line) through the cricoid cartilage indicates the complete laryngo-fissure—only occasionally necessary in subglottic extension of a growth.



FIG. 14.—Thyroid cartilage shears. $\frac{1}{2}$ scale.

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strongly made and are used in the same way as scissors. They will divide the cartilage with one clean cut without causing any crushing or damage, thus avoiding the risk of perichondritis and sepsis, which has in some cases followed the use of other instruments.

Prior to the introduction of these shears it was not uncommon to find the occurrence of necrosis of a portion of the thyroid cartilage, as a result of smashing or crushing with scissors or bone forceps.

The lower blade has a very fine saw edge to prevent lateral slipping during cutting, and is curved and pointed to facilitate its introduction through the crico-thyroid membrane, under the lower edge of the thyroid cartilage, and upwards between the vocal cords. The upper blade is provided with a sharp spike at the extremity of its cutting edge in order to assist in transfixing the larynx and keeping it steady during the cutting. The larynx can therefore be carefully divided through the anterior commissure so as not to injure either vocal cord. The position of the handles in relation to the blades is such that they lie well above the neck, so that the tracheotomy tube already inserted in the trachea does not get in the way of the operator's hands.

Experience has proved the great advantage of these cutting shears over any other instrument used for this purpose. They may also be used in the treatment of stenosis of the larynx by the operation of laryngostomy—*i.e.*, laying open the larynx anteriorly by fissure of the thyroid and cricoid cartilages and keeping it open for a long period of treatment. In such a case they will divide the cartilages, whether ossified or not, and soft parts, including the skin, at one cut.

Figs. 15, 16 and 17 show the correct way of introducing the cutting shears in the operation of laryngo-fissure. The sharp-pointed lower blade of the instrument is seen entering the crico-thyroid membrane to reach its position between the vocal cords. It also shows the position of the patient's head, neck, and shoulders, the head being supported by an assistant

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so as to keep the parts in the middle line, but this is not as good a posture as that shown in Fig. 19.



FIG. 15.—Lateral view of head and neck showing the Rose or hanging-head posture, also the correct way of introducing the lower blade of the thyroid shears through the crico-thyroid membrane into the larynx between the vocal cords.

Figs. 16 and 17 show the position of the shears in cutting through the thyroid cartilage. The instrument is removed by releasing the pressure of the fingers on the lower handle,

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which causes the upper blade to spring back and leaves the lower blade to be withdrawn in the opposite direction to its introduction.



FIG. 16.—The same showing position of the shears in cutting through the thyroid cartilage.

Thyroid Cartilage Saw (Fig. 18).—This is a small, fine saw which is not so cumbersome as those formerly in use. It is intended for partially sawing the larynx before using the

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shears in those cases in which the upper and lower edges of the thyroid cartilage are ossified, as is so frequently met with in elderly people ; or it may be used to saw partly through the whole length of the thyroid angle in the middle line in order to make a groove for the cutting shears. The depth of the saw blade is only 4 mm., so that it is unlikely to do any

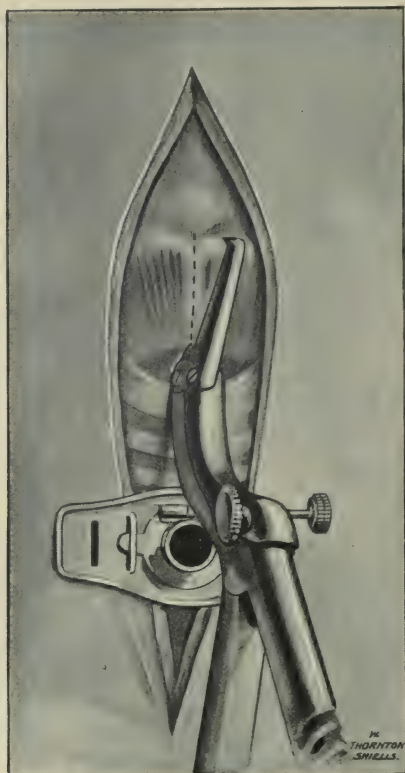


FIG. 17.—Anterior view of larynx showing the lower blade of the shears, which has been inserted through the crico-thyroid membrane between the cords, whilst the position of the upper blade is seen previous to the operator closing the handles and cutting through the cartilage. Observe that the tracheotomy tube is not in the way of the shears.

damage to the intra-laryngeal soft parts. The shaft is bent in such a way that when the saw is used by the operator standing above the head of the patient, the patient's chin does not get in the way of the operator's hands (Fig. 19). If it is used from below the operator's hands are well away from

the neck and do not come into contact with the tracheotomy tube.

The position of the head, neck, and shoulders as represented in Fig. 19 has been found by experience to be more satisfactory than that shown in Figs. 15 and 16, where the head hangs over the end of the table, and causes congestion. The cushion under the shoulders produces extension of the head, whilst a sand-bag under the neck causes marked prominence of the middle line of the neck, and steadies the larynx and trachea. In this position the trachea is drawn out of the thorax, a great advantage in cases where a low tracheotomy is necessary.

If insufficient room is obtained the thyroid cartilage

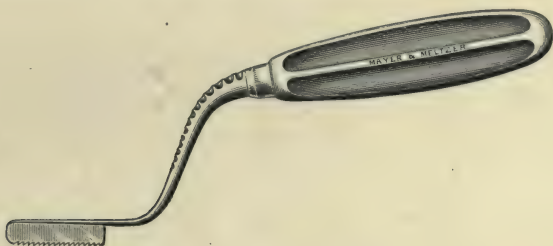


FIG. 18.—Thyroid cartilage saw. $\frac{1}{2}$ scale.

incision may be enlarged by continuing it upwards through the thyro-hyoid membrane and downwards through the crico-thyroid membrane. If this is done there is one entrance extending from the bottom of the hyoid bone to the top of the cricoid cartilage.

It has been advised, in order to obtain extra opening of the thyroid alæ, that the crico-thyroid membrane should be divided transversely along the lower border of the thyroid cartilage, on one or both sides, as may be found necessary, or that the thyro-hyoid membrane should be divided along the upper border of the thyroid cartilage. Rarely, if ever, will this be found to be necessary. Joseph Leidy¹ (Philadelphia) points out that the division of the crico-thyroid membrane in this position is apt to injure subsequent vocal-

¹ "Trans. Amer. Laryngol. Assoc.," 1886, viii, p. 17.

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isation owing to the direct continuity of the vocal cords with it.



FIG. 19.—Lateral view of head and neck showing the best posture for the thyro-fissure operation, also when a low tracheotomy has to be performed. The method of holding and using the saw is seen. The thumb and first finger of the left hand are steadying the larynx, whilst also acting as support for the saw to prevent it slipping off the cartilage.

Shurley¹ (Detroit) refers to the anterior insertion of the true vocal cords as being blended on the sides of the crico-

¹ "Dis. of Throat and Nose," 1900, p. 18.

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thyroid membrane, which explains the frequent impairment of the voice following the operation of thyrotomy if the

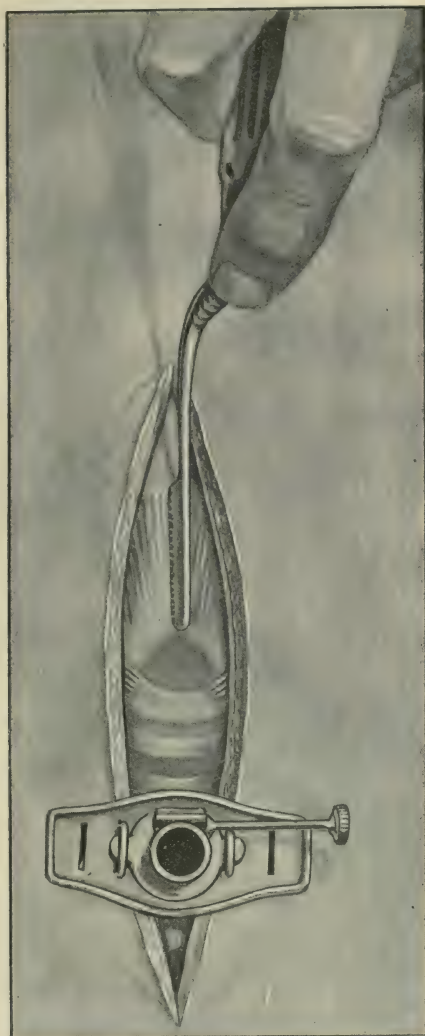


FIG. 20.—Anterior view of larynx showing position of saw or shears—slightly to the right of the middle line—so as to avoid cutting through the growth in a case where a growth on the left cord has extended to the anterior commissure.

crico-thyroid membrane is separated from the lower border of the thyroid alæ. In extension of the disease into the

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subglottic region the operation becomes considerably complicated, and it may be necessary to split the cricoid cartilage in order to obtain more room, but this should be avoided if possible, since the cricoid ring is the main support of the upper part of the trachea, and any damage to it or loss of substance may lead to stenosis.

Swabbing of the Larynx with Cocaine.—Having divided the thyroid cartilage, a long-handled bivalved nasal speculum should next be introduced between the two halves and gradually opened so as to expose the larynx (Fig. 21). During this separation it may be found that a portion of mucosa in the upper half of the larynx has not been completely severed, and will require division with a knife. On entering the larynx hæmorrhage very rarely occurs; if it does, it may be easily controlled by cocaine or gauze pressure. Adrenalin solution is applied by some operators to contract the blood-vessels and lessen the immediate hæmorrhage of the excision, whilst at the same time to facilitate definition of the growth. It is recommended, however, that a piece of gauze soaked freely in a 5 per cent. solution of cocaine should be inserted into the larynx (Fig. 21), left there for a few minutes, and the speculum withdrawn; merely wiping out is not sufficient. This not only controls any laryngeal reflex, but also renders the operation area anæmic, and is also of great service in defining the limits of the growth. Cocaine alone is preferable to adrenalin or as a mixture with adrenalin, because with the latter secondary hæmorrhage is more likely to occur.

Tamponage of the Trachea.—After a few minutes' interval the thyroid alæ are again separated by the speculum and the gauze removed. A sponge to which is attached a tape or silk thread, or preferably a tampon, as recommended by Uruñuela¹ (Madrid), consisting of a length of 1 in. sterilised gauze tied up at one end in a knot, is passed through the opening and packed tightly down through the trachea upon

¹ E. Uruñuela, "Trans. Thirteenth Internat. Cong. Med. Paris," 1900. Abstract, *Journ. of Laryngol., Rhinol., and Otol.*, 1900, xv, p. 612.

the tracheotomy tube in order that no blood may pass down (Fig. 22). A sponge tampon may also be inserted through the upper part of the larynx into the lower part of the pharynx

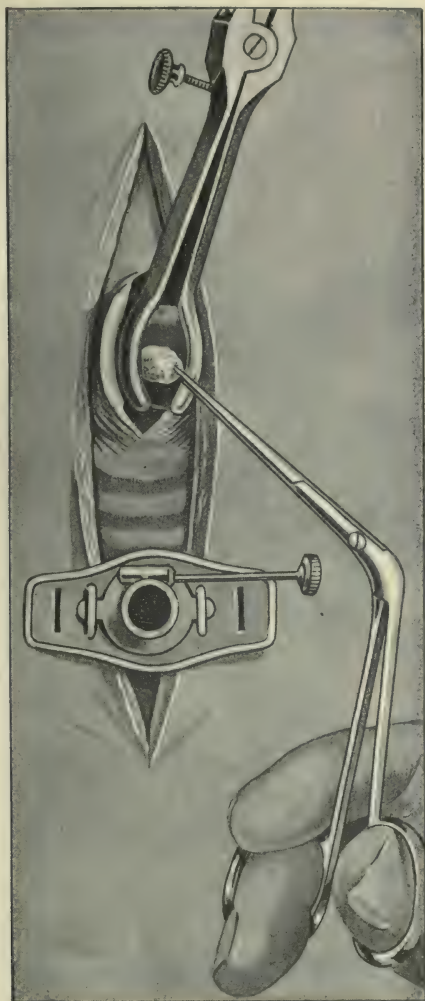


FIG. 21.—Dilating speculum in position between the severed thyroid cartilage in order to open the larynx for the introduction of a cocaine gauze swab.

in order to prevent saliva and mucus from passing into the larynx and covering the field of operation, but this will not often be found necessary.

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Separation of the Thyroid Alæ by the Author's Self-retaining Retractor, and Examination of the Growth.—To carry out the operation successfully it is most important that the thyroid wings should be widely separated, so that the field of operation may be fully displayed and room allowed for easy manipulation of instruments. StClair

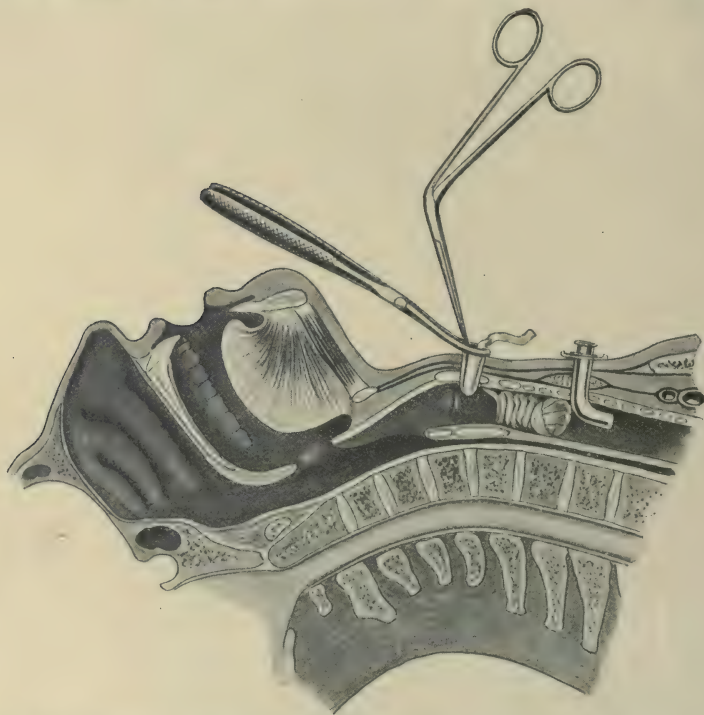


FIG. 22.—Sagittal section of the head and neck showing : (1) Importance of posture in relation to the drainage of blood or secretion from the field of operation. (2) The layers of the deep cervical fascia and position of the great vessels in relation to the over-extended position of the head and neck. (3), Position of tracheotomy tube in the trachea in median tracheotomy. (4) Gauze tampon in position above the tracheotomy tube, thus completely cutting off the trachea from the side of operation.

Thomson¹ remarks that the thyroid wings cannot be forcibly separated and that he has overcome this difficulty by "semi-dislocating the larynx on the spinal column," thus obtaining an oblique view. Though this procedure may be useful in the initial stage when starting the perichondrial

¹ "Proc. Roy. Soc. Med.," 1916, ix (Sect. Laryngol.), p. 8.

resection, it does not dispense with the necessity of hand retractors during the rest of the operation, the disadvantages of which are that traction must necessarily be irregular and unsteady, also the amount of strain that the larynx will stand without damage cannot be estimated. To get over this difficulty the author has designed and introduced a simple, self-retaining graduating retractor (Fig. 23) which secures more ample working space, and it is especially useful after the first quarter of an inch of perichondrium has been raised from the thyroid wing, for then the retractor hooks may be inserted between the perichondrium and cartilage, and they are not in the way during the rest of the operation.

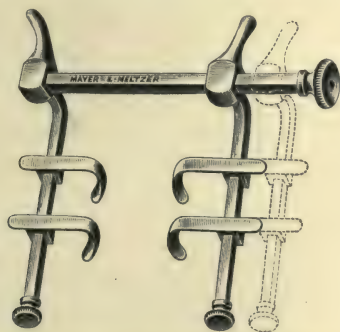


FIG. 23.—Self-retaining adjustable retractor. $\frac{1}{2}$ scale.

Self-retaining Thyro-fissure Retractor (Fig. 23).—This instrument is made on the principle of an abdominal retractor, and can be used either for the cervical skin incision (Fig. 13), the thyro-fissure (Fig. 24), or the complete laryngo-fissure. It is most useful for separating the lateral halves of the larynx after they have been split open by the shears and retaining them in any position. With this retractor the larynx may be opened and closed, gradually or quickly, with the greatest facility, without overstraining or damaging the two separated alæ of the thyroid cartilage, which may occur with ordinary hand retractors, and may give rise to subsequent discomfort and difficulty in swallowing. By the use of this retractor a wide opening of the larynx may be assured, and a fine view of the interior of the larynx be

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obtained. The diseased cord is in this way readily accessible. The retracting hooks may be so adjusted, or one removed on either side, that they do not interfere with the dissection of the growth from the inner wall of the larynx (Figs. 24, 26, 27, 28). It can also be used if necessary to hold back the

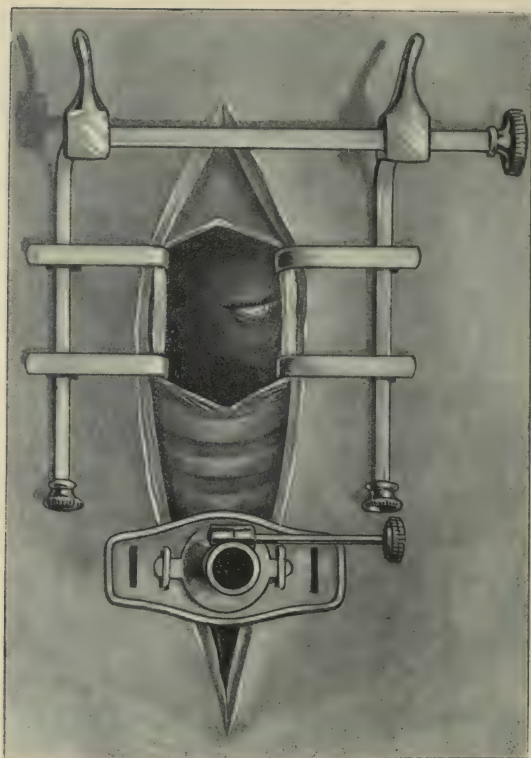


FIG. 24.—Extensive view of the open larynx obtained when the two halves of the thyroid cartilage are held apart by the author's self-retaining retractor. A malignant growth is seen on the centre of the left vocal cord. Note the ample room for the manipulation of instruments.

skin and soft parts during the preliminary operation of tracheotomy (Fig. 13). It therefore does away with the necessity of one assistant.

The interior of the larynx must be properly illuminated, and this is best carried out by means of an electric lamp attached to a headband and supplied from an accumulator,

the light from which can be projected into the cavity of the larynx. The operation-room may also require to be darkened.

It will be observed on first opening the larynx that the appearance is quite different from the laryngoscopic view. Instead of the two white vocal cords which one expects to see, there may be, at first, difficulty in locating them. The definite landmarks of the ventricles, however, stand out well, and if these are first located, their boundaries—the ventricular band above and the vocal cord below—may then be easily made out.

The location and character of the growth can now be studied. It is generally found to be more extensive and deeper than when previously seen in the laryngoscopic mirror; what appeared to be but a small nodule may now be found to be only a small portion of the whole disease, which may perhaps have extended into the ventricle of Morgagni or the subglottic space (Figs. 29 and 30). With the naked eye the growth may be seen to have a cartilaginous appearance with a clear space all round. Examination with the finger is of the greatest importance, since with a malignant growth there is a peculiar cartilaginous feel which is almost pathognomonic.

CHAPTER XII

SUBPERICHONDRIAL RESECTION OF THE GROWTH

A PERICHONDRIAL elevator (Fig. 25) is first inserted under the perichondrium at the cut edge of the thyroid cartilage (Fig. 26), and the soft parts, together with the perichondrium, are raised off the inner surface of the thyroid cartilage, as is done in the parallel operation of subperichondrial resection of the nasal septum, the instrument being worked upwards, downwards, and backwards, until one can get no further, as far as the vocal process of the arytaenoid, leaving the inner surface of the thyroid cartilage bare. As the cartilages are usually ossified in these cases, periosteal rather than peri-

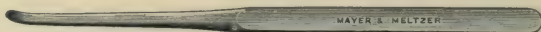


FIG. 25.—Perichondrial elevator. $\frac{2}{3}$ scale.

chondrial resection would, perhaps, be the more correct description. This procedure—*i.e.*, the removal of the soft parts along with the perichondrium—first suggested by Solis-Cohen¹ as a safeguard against possible deep infiltration and involvement of the perichondrium, was a marked advance on the older method of removing the growth along with the soft parts whilst leaving the perichondrium intact. Having completed the separation from the thyroid cartilage, the growth, including, at least, $\frac{1}{4}$ in. of surrounding healthy tissue, is clipped round with scissors, first below, then above (Fig. 27), and then round at the back, including the vocal process of the arytaenoid (Fig. 28), or, if necessary, to be certain of

¹ *Laryngoscope*, 1907, xvii, p. 367.

getting a wide margin of tissue free from the disease, a large part of the arytaenoid itself may have to be removed. The first incision should always be made below the growth (Fig. 27), in order that if much bleeding occurs it will not obscure the second semicircular cut, otherwise the operator will be prevented from judging the amount of healthy tissue round

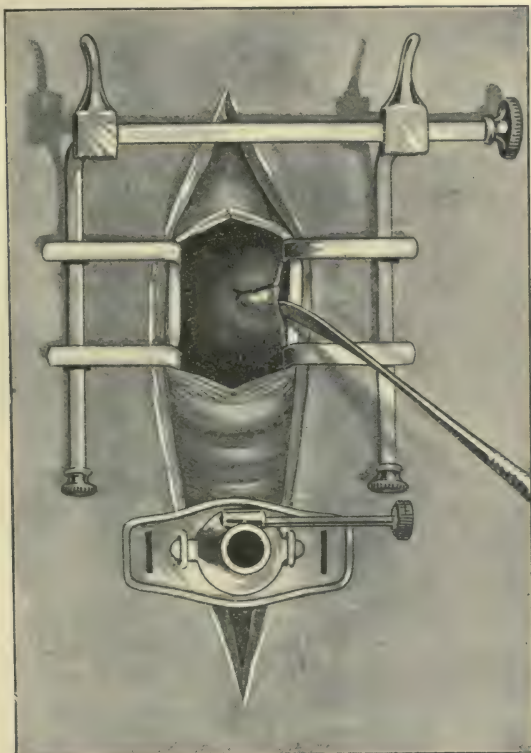


FIG. 26.—View of open larynx showing elevator being inserted under the perichondrium at the cut edge of the cartilage—in the first stage of removal of the growth.

the growth which it is necessary to remove. The advantage of this method is that the growth can be removed *en masse* in one piece untouched by any instrument, looking like “a miniature mass of flesh upon a fleshy plate” (Solis-Cohen)¹ (see Fig. 28).

Intra-laryngeal Scissors (Fig. 31).—(a) Straight blades ;

¹ *Laryngoscope*, 1907, xvii, p. 367.

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(*b*) straight blades with angular shafts ; (*c*) blades curved at right angles ; and (*d*) blades curved on the flat. These have been made with small yet very strong blades, and long shafts which are strengthened to prevent strain and consequent weakness in the cutting blades. After the perichondrium with the soft parts have been raised from the inner wall of

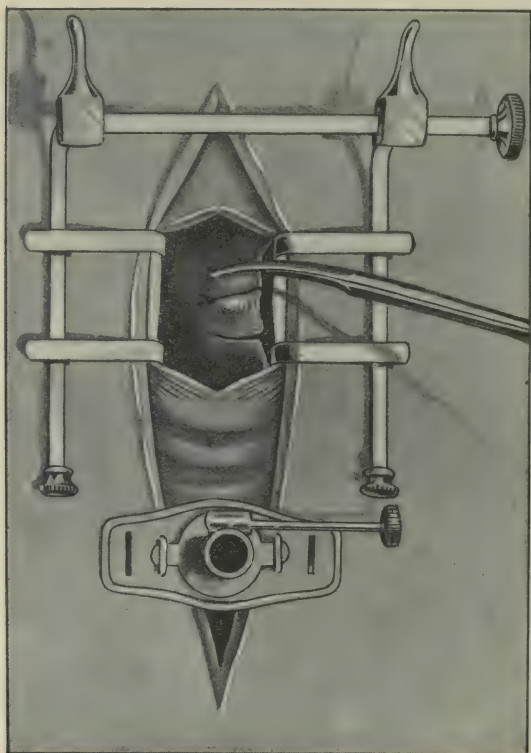


FIG. 27.—View of open larynx—the perichondrium along with the soft parts have been separated from off the inner surface of the thyroid cartilage by the elevator. The lower crescentic incision made by the scissors is seen, whilst the upper incision has just been completed.

the larynx by the periosteal elevator these scissors are of great service, for they can be easily manipulated inside the laryngeal cavity without interfering with the view ; consequently, the entire cutting away and removal of the growth may be performed under direct vision. The straight scissors or those curved on the flat are used in making the upper and

lower incision—*i.e.*, above and below the growth—from before backwards. The rectangular scissors are used to separate the mass posteriorly from the arytaenoid cartilage.

If the growth has extended to the anterior part of the opposite cord, a portion of this must be removed or the entire cord may have to be sacrificed. If only the vocal process

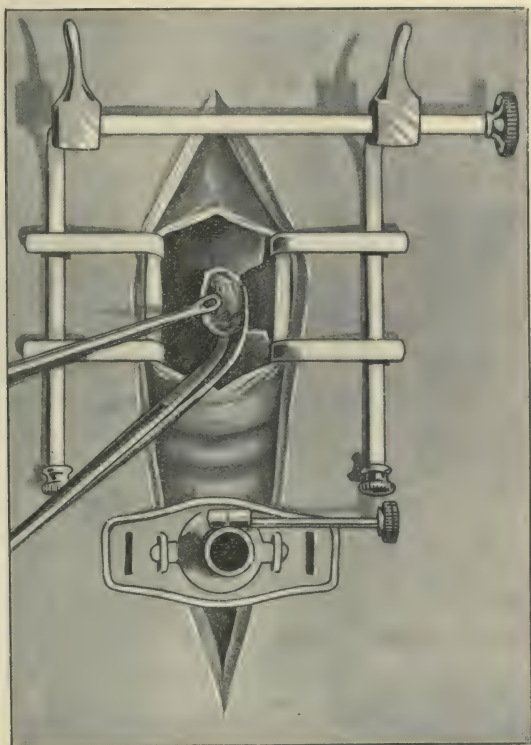


FIG. 28.—View of open larynx—showing separation of the mass from the arytaenoid cartilage by means of the rectangular scissors, whilst the growth is seen along with its accompanying perichondrium securely held by the non-crushing forceps.

is divided, no disturbance results; but if the greater part of the arytaenoid has to be removed, interference with swallowing of food and mucus may follow. Dundas Grant¹ refers to the importance of preserving, if possible, the attachments of the sphincter laryngis, for its presence diminishes regurgitation of liquids during drinking.

¹ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Laryngol.), p. 37.

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Dan McKenzie¹ mentions a case in which he performed thyro-fissure, where it was necessary to carry the excision of the growth well into the arytaenoid region. As a result, swallowing was interfered with, and the food came through

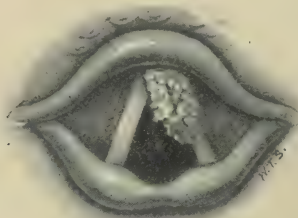


FIG. 29.—Epithelioma of the larynx in a patient, aged seventy. Laryngoscopic view of the growth, apparently only involving the anterior half of the left vocal cord.

the tracheotomy tube. The patient developed pneumonia, which proved fatal.

Hamilton White² (Montreal) refers to a case in which the growth had invaded the arytaenoid cartilage and necessitated its removal along with the vocal cord. Beyond some difficulty in swallowing liquids, which were apt to be brought

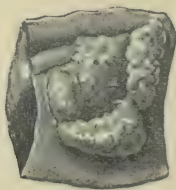


FIG. 30.—Life-size drawing of growth removed by the author *en masse* by thyro-fissure, together with the perichondrium and soft parts, from the larynx shown in Fig. 28. The margin of healthy tissue around the growth is well seen, also the cut surface of the vocal process of the left arytaenoid in the upper left-hand corner. On comparing the specimen with the laryngoscopic view, it will be seen that the latter shows but a small portion of the actual growth, which has extended into the subglottic region.

(Drawn immediately after removal.)

up through the wound, for a few days, no further trouble occurred.

¹ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Laryngol.), p. 36.

² *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, p. 114.

StClair Thomson¹ refers to a case where the invasion of the arytaenoid region involved extensive removal of the arytaenoid end of the cord, and this was followed by some cicatricial contraction and slight glottic stenosis with some dyspnoea on exertion. He remarks that saving the patient's life is of more importance than the question of slight stenosis.

Some operators make a deep elliptical incision round the growth by means of a knife, right down to and including the perichondrium, the incision being made first behind, from the



FIG. 31.—Intra-laryngeal scissors. (a) Straight blades. (b) Straight blades with angular shafts. (c) Blades curved at right angles. (d) Blades curved on the flat. $\frac{1}{2}$ scale.

extremities of which incisions are brought forward above and below the growth. The perichondrium is then raised with a dissector at the most accessible point, and, finally, the mass is removed intact with a pair of scissors. In growths which are situated some distance from the anterior commissure Solis-Cohen² adopts this method, whereas if the growth is anterior or near the commissure he advocates

¹ "Proc. Roy. Soc. Med.," 1917, xi (Sect. Laryngol.), p. 14.

² *Laryngoscope*, 1907, xvii, p. 367.

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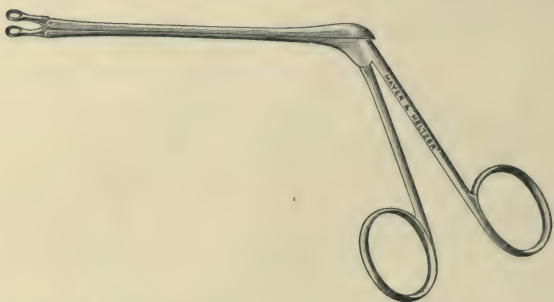
elevation of the perichondrium from the cut edge of the thyroid cartilage (as previously stated).

Re-infection of the Wound by Cell Transplantation.—The importance of avoiding this reinfection has been referred to by many writers. Lack,¹ amongst others, has discussed this matter in full.

Charles Ryall,² referring to the risk of the surgeon re-infecting his patient by incising or lacerating the growth during operation, so causing the escape of cancer cells and infection of the wound, says: "Cancer implantation as a causation of cancer recurrence is, in my opinion, insufficiently



Straight intra-laryngeal forceps. $\frac{1}{2}$ scale.



Angular intra-laryngeal forceps. $\frac{1}{2}$ scale.

FIG. 32.—Non-crushing forceps for holding the edge of the growth.
(a) Straight. (b) Angular.

recognised at the present time. It is of comparatively frequent occurrence, and is a real and exceedingly grave danger."

Crile³ advises that to avoid reimplantation of cancer cells no instrument or sponge that has touched the cancer surface should be used again, nor should they touch anything else that may be used again in the operation.

¹ *The Lancet*, 1896, vol. i, p. 1638.

² "Cancer Infection and Cancer Recurrence: a Danger to Avoid in Cancer Operations," *Lancet*, 1907, ii, p. 131.

³ "Operative Surgery of the Nose, Throat, and Ear," by Hanau W. Loeb. Review in *Journ. of Laryngol., Rhinol., and Otol.*, 1915, vol. xxx, p. 511.

Intra-laryngeal Forceps (Fig. 31).—These are especially useful for grasping the growth, or, more correctly, the healthy surrounding margin of the growth, during its removal with the scissors. They are made with smooth circular unserrated ends which prevent tearing into or crushing the growth, such as may occur with ordinary dissection or tenaculum forceps, and consequently the risk of reinfecting the wound by cell transplantation is avoided. These forceps may also be used for inserting the tethered sponge or gauze into the trachea after the larynx has been opened. They are made either straight or angular (Fig. 32) to suit the convenience of operators.

The Method of Butlin and Semon.—Since Butlin¹ and Semon were largely responsible for the revival of this operation in this country, and for certain modifications in the after-treatment which rendered it less fatal than formerly, it is interesting to note the manner in which they operated :

The shoulders and neck were raised and the head thrown back.

The skin incision extended from the hyoid bone almost to the sternum, and the structures were divided right down to the thyroid cartilage and trachea, including generally the isthmus of the thyroid gland. The vessels, mainly veins, were clamped. The trachea was freely opened below the cricoid cartilage and Hahn's tube with its sponge covering introduced ; ten or twelve minutes then elapsed before the trachea was opened to allow the swelling of the sponge to completely occlude the trachea and thus prevent blood and secretions entering the air-passages. The thyroid cartilage was then split, the incision being carried up beyond the upper border of the thyroid cartilage through the thyrohyoid membrane in order to gain as much room as possible. The two alæ were held widely apart by means of silk threads passed through each, and the interior of the larynx was swabbed out with a 20 per cent. solution of cocaine. An incision was carried around the growth with knife or scissors.

¹ " The Operative Surgery of Malignant Diseases," 1900, p. 191

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The included area was cut out right down to the cartilage, which was laid bare and scraped with a Volkmann's spoon. The cavity was then plugged with iodoform gauze for two or three minutes. The gauze was then removed and the surface dusted with powdered iodoform. The thyroid alæ were brought together with a couple of silk or silver sutures, the Hahn's tube was removed immediately after the operation, and in their later cases no other tube employed in its place, the edges of the wound in the soft parts were brought together, except at the lower part, where the tube had been inserted.

Butlin and Semon in their earlier cases were in the habit of using Hahn's tube during the operation and replacing it after operation by an ordinary tracheotomy tube, which was left in for a few days.

During recent years Hahn's and other sponge-covered cannulæ have been dispensed with by most operators, for it was found that the surrounding sponge required ten or more minutes before it became sufficiently swollen to occlude the trachea from the entrance of blood, and frequently the sponge never expanded at all. Apart from this risk it supplied a septic focus which was sufficient to condemn it.

StClair Thomson¹ last used Hahn's tube in 1906, and says that the only case of pneumonia he had in his cases up to that date was an early case where he used Hahn's tube.

Some operators, *e.g.*, Chiari,² Kocher, still use a tampon-cannula, which is replaced at the end of the operation by an ordinary cannula, a tampon being placed and left in the larynx for three to eight days so as to prevent the entrance of blood, wound secretions, and saliva into the trachea during the first few days after the operation. By this means they maintain any risk of secondary hæmorrhage is prevented, and no special post-operative position for the patient is required.

Hæmorrhage during Removal of the Growth.—In the removal of the growth a considerable amount of bleeding may occur, which can easily be controlled by gauze pressure—dry adrenaline gauze being the best for this purpose—

¹ *Brit. Med. Journ.*, 1912, i, p. 359.

² "Trans. Amer. Laryngol., Rhinol., and Otol. Soc.," 1909, p. 16.

but if there is a bleeding point artery forceps may be necessary.

Butlin¹ says he has never seen bleeding which could occasion the least anxiety.

Persistent oozing frequently occurs during separation of the muscular attachment round the arytaenoid, and a small vessel may be found between the arytaenoid and lateral wall of the thyroid cartilage, which occasionally spurts and gives trouble. It should be pinched with pressure forceps, and may perhaps require ligaturing. For bleeding in the larynx, the cautery is advised by some American writers; but it has been shown that the voice is not so good afterwards, and is only mentioned here to be condemned. Laceration, the result of rough operation, or cauterisation of the laryngeal tissues, may be followed by extensive inflammatory reaction and narrowing of the air-way.

Subglottic Extension of the Growth.—If the disease has extended into the subglottic region, it is difficult to remove it from the inner surface of the cricoid plate, because here the perichondrium is more firmly adherent, and there is a break in the continuity of the perichondrium of the thyroid and cricoid cartilages. It is especially difficult to get beyond the growth in those cases where the growth has extended in between the thyroid and cricoid cartilages, and infiltrated the muscles in this position (Fig. 33). These subglottic extension cases are the more serious because recurrences are more apt to occur in them. In such cases, where the removal of much tissue or division of the cricoid cartilage is necessary to reach the growth, stenosis is likely to occur.

Partial Removal of the Thyroid Cartilage.—Broeckaert² (Ghent) in 1914 demonstrated in Paris what he termed a "window resection" of part of the larynx, leaving the upper and posterior borders of the thyroid wing—a procedure which, he says, places the operation midway between thyro-fissure and hemi-laryngectomy.

¹ Butlin, *op. cit.*, p. 191.

² Discussion on Lambert Lack's case of "Partial Excision of the Thyroid Cartilage as an Alternative to Thyrotomy," "Proc. Roy. Soc. Med.," 1916, ix (Sect. Laryngol.), p. 65.

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Bond¹ refers to a case in which, as long ago as 1892, he had removed a large part of both thyroid plates, leaving the superior and posterior borders, whilst at the same time he removed a portion of the cricoid.

Wilfred Trotter² has removed one or other of the thyroid alæ some fifty times during the past ten years for the

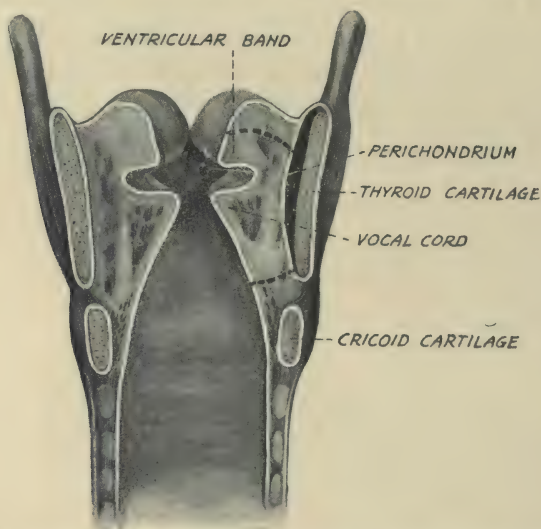


FIG. 33.—*The subglottic region.* Coronal section of the larynx, seen from the front. Dotted line shows the extent of tissue removed when the growth is confined to the vocal cord or ventricular band. On the left side the perichondrium has been raised, together with the soft parts from the inner surface of the thyroid cartilage, and the absence of continuity between the perichondrium of the thyroid and cricoid cartilages is well seen, thus illustrating the difficulties of separating between the thyroid and cricoid cartilages in subglottic extension of the growth.

removal of extrinsic laryngeal growths, without any ill-effect.

Lack³ has described and summarised the difficulties of the laryngo-fissure operation as mainly due to the fact that

¹ *Op. cit.*, p. 64.

² Cited by StClair Thomson, "Intrinsic Cancer of the Larynx," *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, p. 151.

³ See *The Lancet*, 1896, vol. i, p. 1638. "Partial Excision of the Thyroid Cartilage as an Alternative to Thyrotomy in Malignant Disease of the Vocal Cords," "Proc. Roy. Soc. Med." (Sect. Laryngol.), 1916, vol. ix p. 62. "Partial Resection or Window Resection of the Larynx for Intrinsic Malignant Disease," *Journ. Laryngol., Rhinol., and Otol.*, 1916, xxxi, pp. 121-128.

“splitting the thyroid cartilage and pulling aside the two halves with retractors gives a very poor view of the interior of the larynx; that with this opening there is great difficulty in manipulating forceps and cutting instruments, also in defining the limits of the growth and removing it thoroughly.” He goes on to say that in thyro-fissure to obtain sufficient access it is often necessary to divide the thyrohyoid membrane and “to pull the two halves of the larynx forcibly apart”; in consequence, the patient after the operation may have “difficulty in swallowing.” Also, that after thyro-fissure there is often “considerable pain for some days,” due probably to the “wrenching apart” and “bruising of the tissues” from the prolonged retraction. He therefore suggests in all cases that the difficulties are best overcome by resecting a portion of the healthy cartilage underlying the growth in one piece together with the growth, either by means of a preliminary thyro-fissure or by a preliminary removal of the cartilage before fissure. In the first case it is evident that this constitutes a further stage of thyro-fissure, and should be considered under the category of sub-hemi-laryngectomy, whilst in the second case the objections are that the extent of the disease cannot be ascertained as by thyro-fissure, whilst reinfection by cell transplantations (the risks of which have been acknowledged by Lack) is more likely to occur through breaking into the growth whilst reflecting the cartilage if the disease has passed beyond the perichondrium and attacked the cartilage.

The chief object, however, of the operation of thyro-fissure is thoroughly to remove the growth with as little destruction of the larynx as will, so far as possible, ensure complete eradication of the disease, while at the same time leaving the patient with a serviceable voice. Since the removal of a large portion of the healthy cartilaginous framework may lead to narrowing and possibly stenosis of the larynx, with consequent impairment of voice, it should be our main endeavour to save rather than destroy, compatible with safety, the healthy surrounding parts.

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Butlin¹ found that cartilage, whether calcified or not, was peculiarly resistant to the progress of cancer; that it was the perichondrium which was affected, and only in the rarest instances was the cartilage itself infiltrated, and then it is involved very late in such cases; therefore, as a rule, it is not necessary to remove the cartilage of the thyroid alæ. He emphasised the point that "intrinsic cancer of the larynx involves the framework of the larynx with



FIG. 34.—Resection of a portion of the thyroid ala. The dotted lines represent the cuts made with the cartilage scissors.

difficulty, so that even when it is seated almost on the surface of the cartilage it is seldom necessary to do more than cut away the face of the cartilage."

If the growth is found to be more extensive, and the cartilage underlying it is affected, then it may be removed. Involvement and perichondritis of the thyroid cartilage may

¹ "The Operative Surgery of Malignant Diseases," 1900, p. 191. Quoted by Jacobson, "Operations of Surgery," 1879, p. 420.

only be revealed at operation, and extensive disease has been occasionally found to exist in the endo-larynx without any visible extrinsic development.

John N. MacKenty (New York), referring to his experiences, says in small unilateral growths of the larynx, thyro-fissure is sufficient, but where the growth is at all progressive or extensive, or growing fast, he is in favour of removing not only the growth, but the cartilage underlying it, by taking a wide section out of the larynx, or doing a hemi-laryngectomy.

The removal of any diseased cartilage underlying the growth has always been carried out in the past, and this constitutes one of the great advantages of thyro-fissure, in that, if the disease is found to be advanced and has extended beyond the limits recommended for classical thyro-fissure, then the operation can always be carried a stage further and a partial hemi-laryngectomy or hemi-laryngectomy performed.

Microscopical Examination of the Growth Removed.—

It should show ample, healthy tissue all round. Three sections at least should be cut, one through the middle, one beyond the anterior edge of the growth, and one posteriorly at the level of separation through the vocal process. Sections of any other pieces of suspected tissue removed after the main growth should also be examined. It is advisable also to examine the gland from the anterior surface of the crico-thyroid membrane. While it is sometimes difficult to determine the limits of the disease, the microscope will show infiltration in the areas which to the naked eye may have appeared normal, or when an insufficient area of healthy tissue has been removed around the growth. The complete and satisfactory removal of a growth may be concluded from the pathologist's report if the investigation has been thoroughly carried out.

The following microscopical report on an intrinsic endothelioma of the larynx removed by thyro-fissure is

¹ Discussion on StClair Thomson's paper, "Intrinsic Cancer of the Larynx," "Trans. Amer. Laryngol. Assoc.," 1914, p. 43.

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reproduced as an example of how such a report should be drawn up :—

1. *Gland from the anterior surface of the Crico-thyroid Membrane.*—Shows no sign of new growth.

2. *Main growth on vocal cord.*

(a) *Middle.*—The cord is invaded by an undoubted squamous epithelioma. The cancer cells are arranged in solid columns penetrating into the muscle plane. A layer of uninvaded muscle as well as perichondrium is present beneath the growth. The excision is well clear of the growth above and below.

(b) *Anterior end.*—Is free of the growth.

(c) *Posterior end.*—Is all free of the growth.

3. *Portion of Arytænoid.*—Is also free of the growth.

Conclusion.—The examination indicates that excision is complete in all directions.

CHAPTER XIII

CLOSURE OF THE LARYNX AND WOUND

AFTER the removal of the growth care must be taken not to close the wound until all bleeding has ceased, and, if possible, the inside of the larynx has become dry and glazed. When the retractor is removed the two halves of the larynx generally come together and readjust themselves, and only require sutures inserted through the soft tissues at the sides of the thyroid cartilage in order to steady and keep the two halves in position until fibrous union has taken place. The drawing together of the separated muscles by deep (buried) sutures is sufficient to steady and keep the thyroid alæ approximated. If the thyroid alæ do not come together, and there is a tendency to override, catgut sutures should be passed through the perichondrium covering the thyroid cartilage, and the two halves drawn accurately together. The sutures should not pass through the cartilage itself, since it has been found that they encourage the formation of granulation tissue.

Formerly, the lower part of the wound was kept open by means of a drainage tube to avoid the possibility of retention of septic material; but, at the present day, the external parts are always brought together by sutures passed through the skin, with the exception of the portion corresponding to the tracheal opening which is left open to favour, if necessary, expulsion of discharge from the wound or air-passages, and to permit the reintroduction of a tracheotomy tube should the necessity arise.

Butlin¹ says: "I think it is much safer to leave this part

¹ Butlin, *op. cit.*, 1900, 2nd edit., p. 191.

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open in order to provide for the ready escape of blood and other liquids from the larynx and trachea, and to guard against cellular infiltration underneath the skin. In order to hasten the convalescence, some operators have lately closed the entire wound ; but I am very much opposed to such a practice, which aims only at shortening what is really a very short after-treatment, and does so with decided risk to the patient."

Semon, in his earlier operations, closed the entire wound immediately after operation and left a tracheotomy tube in position, but later he was accustomed to close only the upper part and leave the lower part open for two or three days until all danger of septic complications had passed.

The wound rapidly heals by first intention with the exception of the tracheotomy wound, which is only a few days later in closing.

Solis-Cohen's¹ suggestion, therefore, of making two incisions so as to leave a bridge of tissue between the thyro-fissure and tracheotomy wounds, on the grounds of more rapid healing, is quite unnecessary.

¹ *Laryngoscope*, 1907, xvii, p. 366.

CHAPTER XIV

REMOVAL OF THE TRACHEOTOMY TUBE

FORMERLY it was always the custom to retain the tracheotomy tube for from twelve to twenty-four hours, but the tendency during recent years has been to dispense with it at once after the operation, which, it must be admitted, is a distinct gain in the technique of the operation, since the patient is better able to cough up mucus or other secretions than if a tracheotomy tube is in the neck. As to whether this is advisable in every case is still a debatable point. When the tube is left in for a few hours the quiet and free respiration which follows relieves the larynx of considerable strain, and consequently there may be less risk of post-operative hæmorrhage. If it is removed and obstruction to breathing occurs through bleeding or œdema of the laryngeal tissues, it may be difficult to find the opening hurriedly and re-insert the tube, especially into the deep trachea, when a low tracheotomy has been performed. There may be trouble with breathing following excision of the growth and swelling through œdema of the ary-tænoid or aryepiglottic fold, which may flap about and require removal. If the surgeon is not on the spot, dangerous dyspnoea may suddenly occur, and the patient may become asphyxiated. Moure¹ (Bordeaux) says that no hard-and-fast rule can be laid down applicable to all cases. The opinion of the writer, after considerable experience, is that the tube may be permanently withdrawn in the majority of cases after operation, without much risk, whilst in a few its immediate removal

¹ *Brit. Med. Journ.*, 1903, ii, p. 1148.

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may seriously endanger the patient's life. It is safer to retain it in those patients who have a high blood-pressure, or when a considerable oozing, difficult to control, has occurred during removal of the growth or may be likely to recur, or where the patient is out of immediate reach of the operator.

W. G. Porter¹ reported the case of a female, aged fifty-nine, on whom he performed thyro-fissure for epithelioma of the larynx, preceded by a tracheotomy. On completion of the operation the tracheotomy tube was removed, and the entire skin wound closed. The patient was placed in bed in the sitting-up position. At first she was congested and coughed up fresh blood, but she gradually became quieter and the bleeding ceased. One hour later, however, a sudden attack of asphyxia occurred; the wound was quickly opened up and the tube re-inserted. The following day the tube was removed. Three days after the operation symptoms of pneumonia supervened, and the patient died on the sixth day.

He remarks that in future he would remove the tube and leave the wound open so that a tube could be easily re-inserted if necessary.

On account of the more superficial position of the trachea in the extended operative posture of the neck, as compared with that of the normal sitting-up or lying position, if a tracheotomy tube is to be retained for twenty-four hours after operation, due allowance should be made for this difference when choosing the length of a tube. A tube which may fit accurately in the operative posture with its flange level with the skin, will, after the patient is placed back in bed, be too short, and may easily slip out of the trachea into the soft tissues of the neck, causing pressure on the front of the trachea, and a condition of extreme gravity may in some cases suddenly arise, especially if any complication such as hæmorrhage or œdema of the larynx occurs. The operator may be out of reach with no one on the spot capable of dealing

¹ "Report (for 1908) of the Ear and Throat Department of the Eye, Ear, and Throat Infirmary, Edinburgh," *Journ. Laryngol., Rhinol., and Otol.*, 1910, xxv, p. 179.

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with the situation. A number of such cases have occurred. This can be avoided by either using a large-sized Durham's tube of, say, 3 in. in length, familiarly known as the "Jumbo" (Fig. 35)—which has, however, the disadvantage of being in the way during the laryngo-fissure operations—or using a short tube for the operation and replacing it by the longer one before the patient leaves the operation-table. The replacement of a longer tracheotomy tube is recommended because, by means of the regulating screw and collar, it may be adjusted to fit the depth of any neck; that is to say, the tube will find its own level (depth), consequently irritation of the tube extremity in the trachea is avoided. Again,

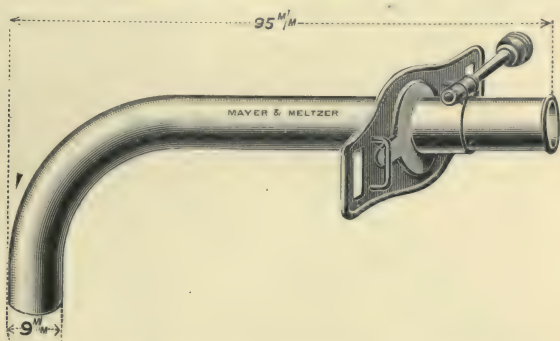


FIG. 35.—Large-sized Durham's tracheotomy tube.

since the mouth of the tube stands out well from the neck, any mucus expectorated through the tube may be easily collected in loose gauze swabs by the nurse, instead of saturating the wound dressing and causing discomfort to the patient. By using these longer tubes it is practically impossible for them to slip out of the tracheal opening. The depth of the trachea from the surface in a low tracheotomy varies considerably, and H. S. Birkett and A. G. Nicholls¹ (Montreal) report a case where unusual difficulty was met with in tracheotomy owing to the great depth of the trachea. It was found to be 3½ in. from the surface and an unusually long tracheal tube was required.

¹ *Montreal Med. Journ.*, May, 1899. Abstract, *Journ. Laryngol., Rhinol., and Otol.*, 1899, xiv, p. 430.

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In view of the difficulty, which sometimes occurs, of finding the tracheal opening when a tracheotomy tube has to be hurriedly re-inserted after operation, especially where a low tracheotomy has been performed and the tracheal opening is deep down in the neck, Ingals¹ (Chicago) has made a valuable suggestion which might be made use of in these cases. If a strong ligature is passed, one through each side of the cut edges of the trachea, at the time of the preliminary tracheotomy, and the ends knotted together on each side,

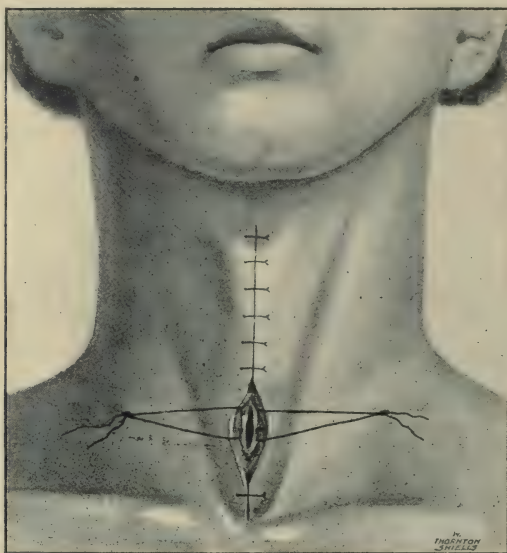


FIG. 36.—Immediate re-opening of the trachea and insertion of a tracheotomy tube.

forming two loops, the trachea may be held open at any moment by drawing on them (Fig. 36). After a laryngofissure is concluded and the tracheotomy tube withdrawn, these ligatures may be left in position for twenty-four hours, and if the necessity should arise of reintroducing the tube these ligatures may be made use of in place of tracheal dilators or hooks, to draw apart the tracheal incision.

If any difficulty in breathing should occur due to bleeding

¹ "Dis. of the Chest, Throat, and Nasal Cavities," 1899, p. 423.

into, or œdema of, the larynx, the nurse, by drawing upon these strings on each side of the neck in place of a tracheal dilator, may immediately re-open the tracheal wound so that the impeded respiration may be relieved and the patient tided over until the surgeon arrives.

MacKenty¹ (New York) recommends that this precaution should always be taken in low tracheotomies and that stout silk threads should be used with the object of controlling the tracheal opening in case the tube should get displaced or come out.

R. H. Woods² (Dublin) has suggested, both as a matter of precaution and as a compromise, that an ordinary bivalved tracheotomy tube should be used and left in the trachea for forty-eight hours, its opening being corked up so that the patient cannot breathe through it. Should any difficulty in respiration occur, the cork can immediately be removed.

Patients can cough and get rid of mucus more easily through the natural passage when the tracheal wound is closed, or with a bivalved tube in position when the opening is blocked, than when an ordinary tracheotomy tube is open.

In every case it is important that the operator or a skilled assistant should be within immediate call for, at least, twenty-four hours after the operation of laryngo-fissure to meet any emergency which may arise (Solis-Cohen).³ A tracheotomy tube should always be at hand, and if the entire neck wound has been sutured immediately after operation, the surgeon should be prepared at a moment's notice to let go the stitches, re-open the wound, and re-insert the tube. In all cases the patient should be left in the care of the most competent nurse, and every detail should be carefully supervised by the surgeon.

¹ *Journ. Laryngol., Rhinol., and Otol.*, 1918, xxxiii, p. 340.

² *Ibid.*, 1899, xiv, p. 185.

³ *Laryngoscope*, 1907, xvii, p. 369.

CHAPTER XV

POST-OPERATIVE POSTURE AND AFTER-CARE OF PATIENTS

FORMERLY, it was customary to keep the patient lying upon the side, near the edge of the bed, without even a pillow, and the head was not allowed to be raised for two or three days. In some cases the feet of the bed were also elevated. This was the posture recommended by Butlin¹ and employed by Semon, and it was expected to ensure the flow of secretions towards the mouth and away from the air-passages and prevent aspiration into the lungs of septic secretions, which gave rise to many cases of pneumonia. It has been found that this position prevented the patient from coughing up easily, and encouraged passive oedema of the lungs.

William Hill² says: "Butlin's posture does not, as the originator hoped it would, prevent the septic secretions going down into the lungs, and if the patient has a weak heart, there may ensue oedema of the lungs, and in some of these cases death has resulted."

Since the position in which the patient is placed during the first few days is one of the main factors of success in this operation, it is interesting to note that it was Francis J. Quinlan³ (New York), who first drew attention in 1909 to the importance of the sitting-up posture, which position is now employed and recommended in all patients operated on by laryngo-fissure. He states that in all cases of this

¹ *Op. cit.*, p. 191.

² "Proc. Roy. Soc. Med.," 1917, x (Sect. Laryngol.), p. 51.

³ Discussion on J. W. Gleitsmann's paper on "Laryngectomy," *New York Acad. Med.*, January 27, 1909. Abstract, *Laryngoscope*, 1909, xix, p. 304.

kind, during the past five years (as far back as 1904), he had set up his patients in bed as soon after the operation as possible, almost in the sitting position, and kept them in this position as much as possible, and the absence of pneumonia which had almost invariably followed these cases was amazing.

In this position patients are much more comfortable, and have the best chance of responding to the cough reflex, the loss of which is one of the greatest dangers following the operation.

Partly in consequence of this more recent posture, if the operation is performed early in the morning, patients may be sitting up in bed the same evening reading the paper (Fig. 37), out of bed the next day, and sitting in an arm-chair for two hours. The following day they may sit up for four hours, after which they may be up all day. On the fifth day they are able to go out walking for an hour, and leave the nursing home in ten days. Patients are not allowed to speak for from a week to three weeks, depending on the intra-laryngeal cicatrisation, and then only in a whisper, gradually increasing until the voice becomes stronger.

Chevalier Jackson¹ allows patients to ask for any requirements three or four times a day in order to give slight exercise to the laryngeal motor mechanism. He considers that slight vocal effort prevents stiffening of the arytaenoid joints.

Difficulty in swallowing, as previously stated, only occurs in those cases where the upper larynx has been injured very much or where a large part of the arytaenoid has been removed, and for a time food may have to be given through a nasal tube to prevent its entering the larynx.

Formerly, when patients were kept on their back and fed by the mouth, food was very apt to get down into the lungs and set up septic trouble, and many patients consequently died.

Butlin and Semon² fed their cases for the first or second day by the mouth, the patient lying with the head hanging

¹ "Peroral Endoscopy," 1915, p. 667.

² "Trans. Med. Soc. Lond.," 1907, xxx, p. 140.

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slightly over the edge of the bed. Food was taken from a feeder, the nozzle of which was introduced into the dependent



FIG. 37.—*Post-operative posture.* Photograph of patient, aged seventy, taken two days after having been operated on by the author, showing the sitting-up position, recommended in all cases of laryngo-fissure, since in this position there is a more ready response to the cough reflex, and septic secretions are prevented from passing down into the lungs. Patient is here seen, supported by a bed-rest and pillows, reading a newspaper.

angle of the mouth. They say that no patient was lost from septic pneumonia which could be traced to that method.

Chevalier Jackson¹ places his patients on their back for the

¹ *Op. cit.*, p. 667.

first forty-eight hours, with sand-pillows on each side of the head to keep it straight in the middle line, so that the approximation of the thyroid cartilages may not be displaced.

As a result of improved operative technique with its reduced traumatism, together with post-operative posture, it is found that patients can now swallow liquids easily the same day. Only sterile water should be given at first in order to

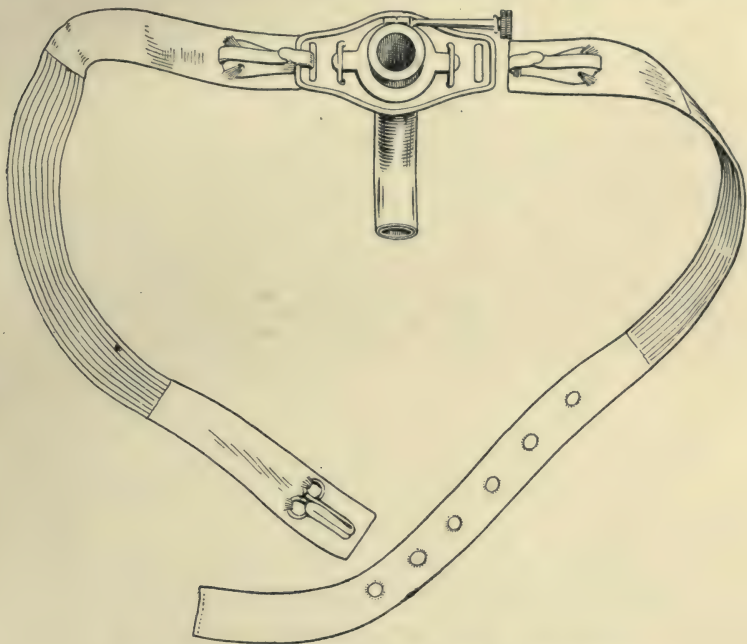


FIG. 38.—Tracheotomy tube neck band (Morell Mackenzie).

see how they can swallow. The patients should lean forward in bed with the head well forward, so that if they cannot swallow properly, and any fluids escape into the larynx, it may run out through the wound in the neck and not pass into the air-passages.

Patients can generally swallow liquids and jellies the next day and solid food on the third day. It is advisable for the first three days that all food should be sterilised.

Mark Hovell¹ has recently demonstrated the advantages

¹ "Proc. Roy. Soc. Med.," 1917, x (Sect. Laryngol.), p. 99.

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of a tracheotomy tube retainer originally designed and used by Morell Mackenzie (Fig. 38). It consists of two lengths of $\frac{1}{2}$ inch tape, with a 3 inch piece of elastic inserted in the centre of each piece of tape. At one extremity of each tape a Nicholl's patent dress hook is sewn, for attachment to the slots on each side of the flange of the tracheotomy tube, whilst the other extremities of the tapes are furnished, one with an ordinary dress hook and the other with adjusting holes. This simple arrangement is much more comfortable for the patient than ordinary tape when a tracheotomy tube has to be worn for some time. It can be taken off and a clean one attached in a few seconds.

Post-operative Hæmorrhage.—However carefully any hæmorrhage may be controlled before closure of the larynx, it is possible that a reactionary or secondary hæmorrhage may occur in from four to six hours. It is more likely to take place in full-blooded or alcoholic subjects, or in those cases where the growth has extended deeply into the sub-glottic area, or posteriorly into the ary-tænoid region, necessitating considerable excision of muscular tissue. Secondary hæmorrhage may be due to a general oozing from the raw surface, and be severe enough to necessitate re-opening and gauze-packing of the larynx, or it may arise from the vessel in the ary-tænoid region and be due to slipping of a ligature applied before closure of the laryngeal fissure.

W. G. Porter in 1910 described a case—previously referred to (p. 101)—in which the tracheotomy tube had to be hurriedly re-inserted on account of asphyxia following an attack of coughing and bleeding. The patient succumbed six days later from pneumonia.

Felix Semon¹ in 1914 referred (in discussion) to having only lost one patient from secondary hæmorrhage, followed by pneumonia, and this he attributed to the use of adrenalin.

Schmiegelow² (Copenhagen) in 1914 mentions that amongst 33 thyro-fissures he had performed, 5 died from pneumonia due to post-operative hæmorrhage.

¹ "Proc. Roy. Soc. Med.," 1914, vii (Sect. Laryngol.), p. 198.

² *Lancet*, 1914, ii, p. 301.

Richardson¹ (Washington) in 1914 referred to a case in which he removed a large growth extending down into the subglottic region, followed by persistent oozing of blood from the angle between the arytaenoid and lateral wall of the thyroid cartilage, necessitating the re-opening of the wound. Also a second case in a patient, aged 70, where the bleeding occurred from the same position.

Fitzgerald Powell² in 1914 (in discussion) confirmed Semon's experience of the risk of secondary hæmorrhage after the use of adrenalin. He referred to one or two cases which he had had, in which considerable hæmorrhage followed before the wound was closed. In one case a very bad secondary hæmorrhage occurred which he attributed to the use of adrenalin.

StClair Thomson³ in 1914 referred (in discussion) to "much hæmorrhage" which was difficult to control, also in 1918 he reported two cases in which sharp hæmorrhage occurred a few hours after operation, controlled by the application of ice to the neck and an injection of morphia, gr. $\frac{1}{6}$. Fortunately in both cases the tracheotomy tube had been left *in situ*, so that re-introduction was unnecessary.

J. W. Bond⁴ in 1918 remarked that in some cases hæmorrhage is severe, and that he had operated upon a case in 1915 in which it was necessary to use eighteen ligatures, probably owing to the fact that the patient was suffering from arterio-fibrosis. From the report of this case, it is not clear whether the bleeding occurred from the superficial vessels in the neck, or from the inside of the larynx.

Bellamy Gardner⁵ in 1919 referred to one patient who was "drowned" by after-hæmorrhage in the night, the tracheotomy tube having been removed after operation.

¹ Discussion on StClair Thomson's paper, "Trans. Amer. Laryngol. Assoc.," 1914, p. 40.

² "Proc. Roy. Soc. Med.," 1914, vii (Sect. Laryngol.), p. 198.

³ *Op. cit.*, p. 197.

⁴ "Proc. Roy. Soc. Med.," 1918, xi (Sect. Laryngol.), p. 153.

⁵ Personal communication to author.

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William Hill¹ in 1919 also reported a case where a spurting vessel in the arytaenoid region required ligaturing after removal of an extensive growth which had spread to the subglottic region. The tracheotomy tube was removed immediately after the operation and hæmorrhage occurred six hours later either from slipping of the ligature or from general oozing. Before the danger was realised and the tube re-inserted, the patient died from aspiration of the blood into the lungs. Hill remarks that if he had kept in the tracheotomy tube a house surgeon would not have hesitated to re-open the laryngeal cavity and pack with gauze.

Another case (personal knowledge of Author) recently occurred in the hands of a colleague, in a patient aged 56. During removal of a large growth which had extended into the subglottic area, considerable bleeding occurred, and was followed two hours later by a sudden hæmorrhage through the tracheotomy tube, which had been left in position. After an injection of morphia, gr. $\frac{1}{4}$, the bleeding ceased, but unfortunately septic pneumonia supervened and the patient died.

Tilley² has also recently (1920) referred to hæmorrhage difficult to control from the neighbourhood of the arytaenoid. If, he remarks, you cannot stop bleeding from the vessel by direct pressure on the bleeding point, you can secure the vessel, just before it enters the larynx, by turning back the skin, etc., from the outer wall of the thyroid cartilage.

From the above records it will be seen that in recent literature seventeen cases of serious hæmorrhage have been reported with ten deaths. In a number of these cases the bleeding was observed during operation and to occur from a spurting vessel in the arytaenoid region.

These cases indicate the necessity for the surgeon to be either on the spot or close at hand to cope with any reactionary hæmorrhage which may unexpectedly occur and may endanger the patient's life.

¹ Discussion on StClair Thomson's paper, "Trans. Med. Soc. Lond.," 1919, xlii, p. 105.

² "Proc. Roy. Soc. Med.," 1920, xiii (Sect. Laryngol.), p. 122.

With a view to ascertaining the exact position and course of this vessel so as to permit of better control during operation, the assistance of Professor Shattock was sought, and the result of our investigations is now recorded.

Fig. 39 shows a dissection of the larynx made from the left side with the arteries injected. (Specimen No. 195, Anatomical Series, from the Museum of the Royal College of Surgeons.) This has been specially drawn for me by kind permission of Professor Shattock and under his super-

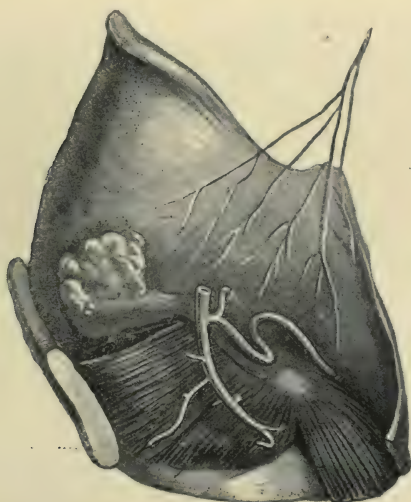


FIG. 39.—Dissection of the left side of the larynx with the superior laryngeal artery and its branches injected. (Natural size.)

(Specimen No. 195, Anatomical Series, from the Museum of the Royal College of Surgeons.)

vision. He has also supplied me with the following description :—

The left ala of the thyroid has been removed. The posterior crico-arytænoid, and above this the thyro-arytænoid, muscles are shown passing to their insertion into the arytænoid cartilage. The ventricle of Morgagni has been opened from the external aspect, and above it lies a portion of the sacculus. The artery of which the upper end is cut across is the superior laryngeal, and from it there arise in order from above down-

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wards: (1) From the inner and posterior aspect, a short branch which subdivides, one branch directed upwards to the mucous membrane, and the other crossing the site of the arytaenoid cartilage, and distributed to the mucosa, &c., behind the posterior crico-arytaenoid muscles. The tortuosity of this vessel is noteworthy and may be referred to the rotatory movements of the arytaenoid cartilage over which it runs. (2) Proceeding downwards, there is a branch, cut short, from the front of the main artery followed by (3) a long offset passing forwards and downwards to the

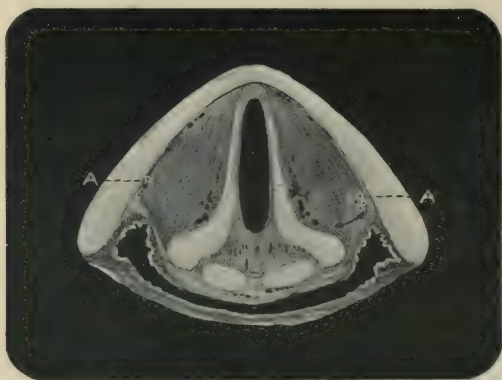


FIG. 40.—Horizontal section of a normal larynx. A, represents the superior laryngeal artery or its branches. (Natural size.)

(Specially prepared by Professor S. G. Shattock, F.R.S.)

thyro-arytaenoid muscle. From this, a short way from its origin, there is a branch which is cut short and probably represents the anastomotic branch between the superior and inferior laryngeal arteries.¹ Next in order comes: (4) A branch passing directly inwards to the thyro-arytaenoid muscle in the neighbourhood of its insertion. And, finally, the vessel terminates by bifurcating to supply the posterior part of the lateral crico-arytaenoid muscle.

Fig. 40 represents a horizontal section of a normal larynx, from a man aged 24, who died, cyanosed, with heart disease;

¹ A coloured illustration showing the distribution and anastomoses of the laryngeal arteries will be found in Luschka: "Der Kehlkopf des Menschen," 1871 Taf. viii, Fig. 1.

the veins are distended with blood. This specimen was specially prepared by Professor Shattock for the purpose of these investigations:—The section is made through the processus vocales, and vocal cords, and shows the mass of the thyro-arytænoid and lateral crico-arytænoid muscles occupying the space between the cords and alæ of the thyroid cartilage. In the more posterior part of the muscular mass there is shown on the left side the transversely divided superior laryngeal artery lying close to the perichondrium, and on the right side, in a corresponding position, but somewhat more deeply in the muscle, there are three small arteries derived from the same source. The veins in the thyro-arytænoid muscle in the angle on the outer side of the processus vocales are conspicuous in number.

The conclusion we may draw from these investigations is that in those cases in which it is necessary to cut through a considerable amount of muscular tissue close up to or including the arytænoid cartilage the superior laryngeal artery may be cut or injured. Since this vessel enters the larynx above the thyroid ala and runs vertically downwards and in this situation lies close against the perichondrium, further separation of the perichondrium from off the thyroid ala is indicated so as to allow the vessel to be more easily seized by pressure forceps and securely ligatured. I think we shall find this practical point of considerable service in future cases which come under our care.

Treatment.—If, after operation, the patient is restless with only slight oozing of blood, as previously stated, an injection of morphia, gr. $\frac{1}{8}$, may be all that is required. If, however, the bleeding is profuse and continuous it may be necessary to re-open the larynx and pack vaseline gauze impregnated with bismuth down upon the tracheotomy tube as recommended after hemi-laryngectomy by John MacKenty¹ (New York), a small drain being inserted into the lower corner of the wound. In this way the larynx is drained of secretion, which is prevented from getting into the trachea and causing

¹ Discussion on StClair Thomson's paper, "Trans. Amer. Laryngol. Assoc.," 1914, p. 43.

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pneumonia. The gauze is removed from the larynx in two days.

William Hill has inserted strips of compressed nasal splinting (Fig. 41) into the larynx in a case where bleeding seemed likely to recur and where he had to leave the patient in unskilled hands. The larynx was left unsutured. This packing acted most satisfactorily and was easily removed



FIG. 41.—Absorbent Laryngeal Splinting.

next day, after which the larynx was closed by sutures. The patient made an uninterrupted recovery.

The author suggests that Herff's metallic suture clips (Fig. 42) will prove of great service in closing the wound after thyro-fissure—in place of suturing—allowing the larynx to be immediately re-opened in any case where hæmorrhage should unexpectedly occur. These clips require no forceps



FIG. 42.—Herff's Metallic Suture Clips.

for applying or removing, as in the case of Michel's sutures, and may be sterilized and used again and again.

Post-operative Injection of Narcotics.—While it is important that the patient should sleep tranquilly, it is seldom advisable to administer morphia for fear of locking up the secretions, and diminishing the normal cough reflexes which are necessary to keep the air-passages clear. It should not be forgotten that if the patient has already had an injection of morphia prior to the operation, followed by an anæsthetic, there is a natural inclination to sleep, and an element of danger may be introduced into these

cases, if opium or its derivatives are recklessly given, by producing a depressing effect on the respiratory centre. If the patient is restless, with a tendency to bleed, or a frequent and irritating cough is present, morphia in small doses (gr. $\frac{1}{6}$) may be indicated. Quiet, natural sleep, with the patient retaining control of the laryngeal and pharyngeal reflexes, is what should be encouraged during this stage. If a derivative of morphia such as *heroin hydrochloride* is used, great care should be taken in the dosage, since many patients are more susceptible to this preparation than to morphia. Again, it is much more active in small doses than corresponding doses of morphia, being a more powerful respiratory sedative. It should be remembered that heroin is three times the strength of morphia, and the dose should be from $\frac{1}{24}$ gr. to $\frac{1}{6}$ gr. as compared with the corresponding $\frac{1}{8}$ and $\frac{1}{2}$ gr. morphia. If, therefore, in susceptible patients, during the post-operative stage, too large or too frequently repeated small doses of narcotics are prescribed, disastrous results may follow, through non-return or incomplete return of the cough reflex, and the patients may "drown in their own mucous secretions."

StClair Thomson¹ refers to this idiosyncrasy in an alcoholic patient, who died forty-eight hours after operation, with drowsiness, contracted pupils, and complete suppression of urine following $\frac{1}{2}$ grain of heroin, in 3 doses of $\frac{1}{6}$ gr. within 24 hours.

Bellamy Gardner² advises that morphia should not be given for twelve hours after the operation, because of the importance of retaining the coughing reflex, and he confirms also the importance of placing the patients back in bed in the sitting-up position, in which they have the best control of their respiratory apparatus.

Hugh R. Phillips³ expresses his opinion that the post-operative use of narcotics immediately after the operation ought not to be needed for some hours if the patient has had

¹ *Journ. Laryngol., Rhinol., and Otol.*, 1919, xxxiv, p. 148.

² Personal communication to author.

³ Personal communication to author.

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an injection previously before coming into the theatre. If none has been given, a small dose of morphia or of omnopon will usually allay the restlessness and enable the patient to remain comfortable. He says it is wiser to give a small dose and repeat if necessary, so that the cough reflex is retained.

CHAPTER XVI

RESULTS OF THE OPERATION

(a) *As regards Recrudescence or Recurrence.*—Whilst malignant disease of the “extrinsic” variety presents early and extensive metastases involving the adjoining lymphatics, in the “intrinsic” variety the disease at first remains a local one owing to being surrounded by a “cartilaginous box” from which the intrinsic lymphatics have a poor connection with the neighbouring glands in the neck.

Carcinoma of the vocal cord grows chiefly in a direction parallel to the long axis of the cord, which it tends to involve completely, or to a very large extent, before it encroaches on surrounding parts; this characteristic method of growth being due to “the arrangement of the submucous lymphatic space of the cord, which forms a closed sac, the boundaries of which separate it from the ventricles of Morgagni and the lymphatic spaces of the subglottic mucosa.” (Blumenfeld.)¹

For these reasons the prognosis of intrinsic cancer of the larynx is, perhaps, more favourable than that of malignant disease in almost any other region of the body (Knight),² but this depends on early diagnosis, early radical operation, and greater care in the selection of those cases suitable for this special operation.

Geo. E. Brewer³ (New York) says: “Not one authentic

¹ Blumenfeld, F. (Wiesbaden), “On the Pathological Anatomy of the Vocal Cord,” *Zeitschr. f. Laryngol.*, vol. iii, part iii. Abstract, *Journ. Laryngol., Rhinol., and Otol.*, 1910, xxv, p. 668.

² “Trans. Amer. Laryngol. Assoc.,” 1904, p. 173.

³ *Laryngoscope*, 1909, xix, p. 601.

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case of carcinoma of the larynx was ever cured, except by early surgical removal of the disease."

Recurrence is likely to take place when the operation has not been thoroughly performed, and the removal of the disease has been only partial.

Some cases of recurrence are probably due to the reinfection of diseased cells, hence the importance of not cutting into or tearing the growth during removal.

Chevalier Jackson¹ considers there is a sound basis for the opinion that recurrences in the scar are due to wound infection at the time of operation quite as often as incomplete removal; they are therefore recrudescences, not true recurrences.

The greatest cause of non-success in the past has been the lack of attention to technique, and the steady improvement in results during recent years is undoubtedly due to a better understanding of the operative work and to the perfection of details, especially of those concerned with the after-care of the patient, by which the prevention of pneumonia—a frequent cause of death in the past—is now assured.

As Delavan² remarks, "improved technique, the special skill and experience of the specialist, the early recognition of laryngeal cancer by the general practitioner, and its prompt treatment are sure to give the best results." However skilful and thorough the operator, the microscope may show that a small piece of the growth has been overlooked beyond the line of excision and left behind, especially posteriorly or in the subglottic region, recognised microscopically by the fact that the excision has passed through malignant growth and that the necessary margin of healthy tissue beyond the growth is not present.

If there should be any doubt as to complete removal the operator must not hesitate to reopen the larynx without delay and remove a further piece.

StClair Thomson³ has performed a second laryngo-fissure under such circumstances on a patient, aged seventy, with a

¹ *Op. cit.*, 1915, p. 665.

² *Med. Record*, 1904, lxvi, p. 446.

³ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Laryngol.), p. 35.

blood-pressure of 200—within ten days of the first operation—resulting in a complete and rapid recovery.

Semon's¹ experience showed that no recrudescence may be feared if patient has remained well for a full year after the operation. He also thinks that the word "cure" can safely be employed unless recurrence takes place within one year of the operation.

The first year has been well described by StClair Thomson² as the "year of probation," and is the most anxious time, especially the first three months. His experience confirms Semon's opinion, but he is somewhat more cautious when he says that if recurrence does not take place during the first year after operation there is "every prospect of permanent cure," also that if cases come back with disease within a year we may conclude that there has been incomplete removal, if after that date it is a recurrence.

Delavan³ considers that since recurrence may take place years after the removal of the growth, no limit of time can be fixed beyond which there will be an absolute certainty of permanent immunity from relapse. One-half and in some instances two-thirds of the patients reported alive at the end of the first year have died within three years. He thinks that the expression "permanent cure" should be used with care, and that three years should be generally considered the minimum allowance of time in which to record a case as one of actual or permanent cure. Statistics based upon alleged cases of less than three years' duration are, therefore, in his opinion worthless.

Because there may be no recrudescence or recurrence of cancer within two or three years of operation Tilley⁴ thinks it is not wise to speak of a "cure." He says that amongst his cases of operation for malignant disease of the vocal cords by laryngo-fissure he has had recurrence in two, five, six, seven, nine, thirteen, and fifteen years after the primary operation.

¹ *Laryngoscope*, 1903, xiii, pp. 833 and 887.

² *The Lancet*, 1914, i, p. 300; "Proc. Roy. Soc. Med.," 1916, ix (Sect. Laryngol.), p. 8.

³ "Trans. Amer. Laryngol. Assoc.," 1904, p. 155.

⁴ "Proc. Roy. Soc. Med.," 1916, ix (Sect. Laryngol.), pp. 7 and 48.

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The last was one Semon¹ had operated on fifteen years previously, and it ended fatally. On the other hand, he has operated² in early intrinsic cases on patients who are still alive, ten, nine, six, four, and three years following the operation.

Since one can never promise a lasting cure it is best that this term should not be used.

The recurrence of the disease may not always be at the same site as shown by a case referred to by Tilley³ where re-growth occurred in the other cord nine years after the

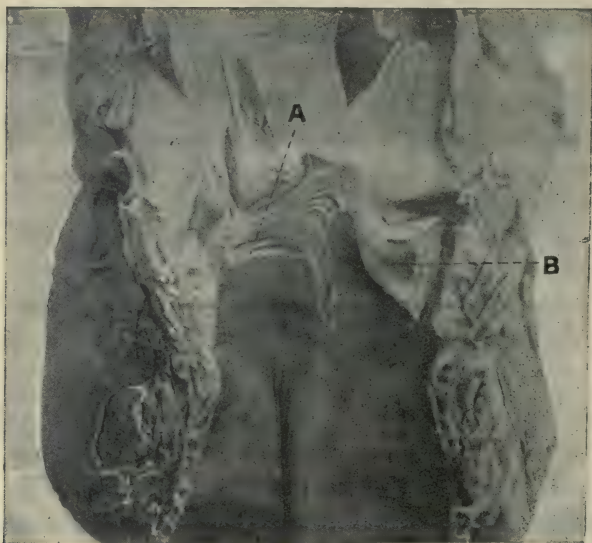


FIG. 43.—*Epithelioma of the Larynx.* A, Healthy scar of operation on right vocal cord; B, Recurrence (or re-deposit) of epithelioma on left vocal cord, thirteen years after removal of opposite cord, for the same disease. (By kind permission of Mr. Herbert Tilley, from "Diseases of the Nose and Throat," 4th edition, 1918.)

primary operation, but both these cases were probably not a true recurrence, and might be considered as a fresh attack.

Amongst his list of recurrences he refers⁴ to a case in which the patient died from asphyxia thirteen years after the primary operation. *Post-mortem* examination of the larynx showed the scar of the old operation perfectly healthy, but

¹ "Proc. Roy. Soc. Med.," 1910, iii (Sect. Laryngol.), p. 33.

² "Dis. of the Nose and Throat," 1918, p. 616.

³ "Proc. Roy. Soc. Med.," 1915, viii (Sect. Laryngol.), p. 36.

⁴ *Op. cit.*, p. 616

there was a well-defined and typical epithelioma in the opposite and formerly healthy cord (Fig. 43).

Though recurrence may not take place in the larynx secondary developments may occasionally occur in other parts of the body (*vide* Metastases, p. 4).

StClair Thomson¹ reports a case where laryngo-fissure was performed and later excision of the larynx. Examination of the larynx showed that the growth had been completely removed by the previous operation, yet five and a half years later there was recurrence in the glands of the neck, without any recurrence in the throat. Also another case,² in which there was recurrence at the base of the tongue on the opposite

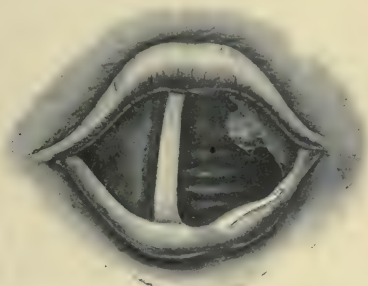


FIG. 44.—Laryngoscopic view of the larynx after the operation of thyro-fissure showing a granuloma on the cicatricial band which has taken the place of the removed cord.

side, yet, as he remarks, “there is but little direct lymphatic connection between the two sites, viz., the right cord and the opposite lingual tonsil.”

Schmiegelow³ reports the case of a patient who died from cancer of the stomach eight years after thyro-fissure for cancer of the larynx; also another who died from cancer of the rectum eighteen years after.

Granulomata.—An apparent re-growth about the anterior commissure sometimes causes anxiety during the first few months of convalescence, but in the great majority of cases may consist of simple granulation tissue. One should,

¹ “Proc. Roy. Soc. Med.,” 1917, x (Sect. Laryngol.), p. 20. Also, *Brit. Med. Journ.*, 1912, i, p. 355.

² “Proc. Roy. Soc. Med.,” 1916, ix (Sect. Laryngol.), p. 8.

³ *Lancet*, 1914, ii, p. 301.

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therefore, not be alarmed and directly proceed to a second operation, as has occasionally been done in the belief that there was a true recurrence. These granulomata are more pedunculated or semi-pedunculated than the original growth,

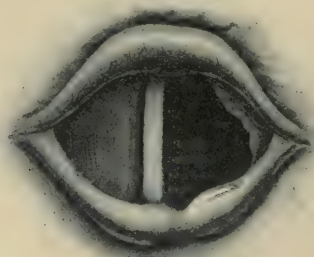


FIG. 45.—Laryngoscopic view of larynx during respiration—nine months after removal of the left vocal cord—in the case of patient aged 70—referred to on p. 108 (Fig. 37). Observe the cicatricial band which has taken the place of the removed cord.

and may occur either in the scar of the former growth (Fig. 44) or the anterior commissure of the vocal cord. They may occur from two weeks to two months after thyro-fissure. In former days they were frequently found round the stitch

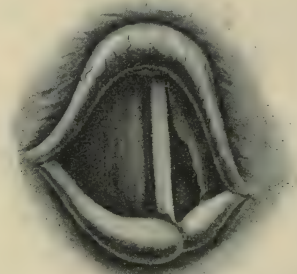


FIG. 46.—The same during phonation. This patient has a very good though somewhat hoarse voice.

when this was passed through the thyroid cartilage at the anterior commissure. They can be successfully removed by forceps either indirectly or endoscopically, and will probably prove to be only fibrous tissue. A second or even

a third recurrence may follow, and require removal by forceps.

(b) *As regards Voice*.—This operation, if carefully performed without injury to the soft parts, only interferes with function to a minimum extent, and usually results in a slightly hoarse but excellent voice, nearly as good as normal. After removal of a vocal cord, its place is taken by a cicatricial ridge, and it is extraordinary what good service this can render (Figs. 45 and 46). For example, Semon¹ showed at the Royal Society of Medicine in 1909 a man, aged forty-five, from whom he had removed an entire cord six months previously, and who was then able to sing with a clear voice. A case has also been reported² by Tilley where a patient, a solicitor, was able to address even company meetings, whilst in another case,³ referred to by StClair Thomson, patient was able to resume his profession as a schoolmaster.

Chiari⁴ reports a case where the patient delivered a course of scientific lectures for a year after the operation, and another where he had removed both vocal and ventricular bands in three thyrotomies, yet the patient, after seven years, could speak quite loud and be understood.

Swain⁵ (New Haven, Conn.) records a case where, six months after operation, a minister had enough voice to preach again. In one case reported both vocal cords were completely removed, yet the patient had a loud, strong, though harsh voice. In another, all the left vocal cord and soft tissue on the left side of the larynx was removed, as also the right vocal cord up to the processus vocalis, yet patient could speak easily and loudly with a strong, harsh voice, which was apparently produced by the vibration of the aryepiglottic folds.

¹ "Proc. Roy. Soc. Med.," 1909, ii (Sect. Laryngol.), p. 79.

² *Ibid.*, 1914, vii (Sect. Laryngol.), p. 192.

³ *Ibid.*, 1910, iii (Clin. Sect.), p. 117.

⁴ "Trans. Amer. Laryngol. Soc.," 1909, p. 22.

⁵ Discussion on Delavan's paper, "Recent Advances in the Treatment of Malignant Disease of the Larynx," "Trans. Amer. Laryngol. Assoc.," 1904, p. 168.

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In some cases a course of exercises for the re-education of the voice may be considered necessary and helpful in improving and strengthening the voice.

The question has arisen lately as to whether the voice is better after removal of a portion of the thyroid ala than when the cartilage is left as in the operation above described. Comparison of cases in the future will doubtless decide this point. So far no appreciable difference has been observed by the writer between those cases in which the new vibratory band is formed from the perichondrium and soft parts covering the external surface of the thyroid cartilage, and that formed from cicatricial tissue within the larynx when the cartilage is left, nor does there appear to be any justification, from this point of view, for the unnecessary sacrifice of healthy cartilage.

Broeckaert's and Lack's suggestion of "window resection," if performed only in advanced cases of endo-laryngeal cancer which have passed the ideal stage of thyro-fissure, and if preceded by a preliminary fissure, should prove of great value in the fact that it retains the framework of the larynx and avoids the risks and disadvantages of hemilaryngectomy; but it can never take the place of thyro-fissure, and should not be considered under that heading.

Improvements in technique and the application of more suitable and efficient instruments have resulted in the difficulties enumerated by Lack and others being overcome.

The operation of laryngo-fissure as now carried out is greatly simplified, the more thorough removal of the disease can be more easily assured, and the risk to life from so-called recurrence, which usually implies imperfect removal, reduced to a minimum.

The illustrations have been drawn for me by Mr. Thornton Shiells from special dissections prepared to show the steps of the operation and the advantage of the instruments employed. The instruments are made to my design by Messrs. Mayer and Meltzer, of Great Portland Street, W.

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